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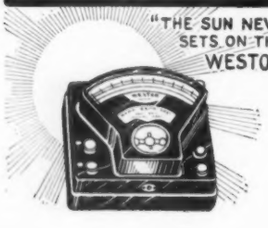

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The consolidation of Electrical World, Electrical Engineer and American Electrician

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Volume 80 — New York, Saturday, December 9, 1922 — *Number* 24

Where the Contractor Stands

FOR many years the contractor has been one of the popular topics of general conversation in the electrical industry. Almost any kind of an "electrical man" will ask—or freely tell you—what's the matter with the contractor. But this comment almost always circles around his weaknesses and failures. It seldom estimates potential values.

Let us consider for a moment just what the electrical contractor does and where he stands in the electrical industry.

NO ONE can question the absolutely fundamental importance of the wiring in a building. Without the wiring installation there can be no electric service in any factory, office, store or dwelling. No electric labor-saving or comfort appliance has any worth there, because it cannot be used. Electric light, heat and power cease to exist for any one. Therefore the electrical contractor, whose function it is to install this wiring and make the benefits of electricity available, plays a vital part.

But the contractor, like the plumber, follows a trade in which the apprentice becomes a journeyman and the journeyman becomes a competitor just as soon as he elects to cut loose from a payroll and take contracts for himself. This "basket contractor," unburdened with overhead and ignorant of costs, can and will ever find small jobs that will be given him at prices lower than established contractors with resources and responsibility can meet, and so he lives. And always there are too many contractors in every city, competing on a minimum quality and profit standard that by squeezing price restricts installations and discourages the use of electric service.

Whose fault is it? Whose problem is it that this process in the work of electrical development has become demoralized?

The electrical industry itself—meaning all classes of electrical men—has simply failed to do for these small wiring contractors what the plumbing industry has so well done for the small plumbing contractor. They have not together spent the time and effort and money necessary to sell to him a full, enthusiastic belief in the principle of creative, constructive competition for higher standards, bigger jobs and better profits. Yet if plumbing could be raised to the present plane of porcelain tubs and brass piping, who can deny that the electrical contractor and the public can be converted to the same idea, expressed in adequate wiring, convenience outlets and complete appliance equipment permanently installed?

THE contractors' association has adopted the word "electragist" to denote an electrical contractor who does "quality" work. This may well have a good influence. But meanwhile the industry depends upon this man to do this vital wiring and to maintain a very close personal contact with the people in each town, the interpreter and representative of *all* electrical men. Can the matter wait?

Waldo Arnold Layman

An engineer executive equipped by many years of manufacturing experience and sound business judgment.

THE acid test of business judgment is consistent accomplishment under favorable and adverse conditions. Just as death is no respecter of persons, so also is leadership in business no respecter of fear, and the mark of the leader is the ability to adjust courses of action to apparent difficulties in such a way as to marshal the courage of others in surmounting them.

For more than twenty years W. A. Layman, as the executive head of the Wagner Electric Manufacturing Company, has stood the test in the demand for initiative, creative engineering thinking and business administration in the development of an organization which has grown steadily through recognition of the quality of its products and because of the service it has furnished to the electrical industry. It was he who made the original drawings of the first Wagner line transformers and direct-current motors thirty years ago, and he played a vital part in the development of the well-known Wagner single-phase motor. In 1894 he became assistant superintendent of the company and in 1898 attained the position of assistant general manager. In 1900 he became treasurer and two years later was made general manager in addition. This two-fold position he filled until 1908, when he was made first vice-president and general manager. For about ten years previous to that time his engineering work for the company consisted chiefly in passing executive judgment on its engineering policies and designs and in investigating new lines of engineering activity. Since 1902 he has had full charge of the financial, engineering and manufacturing interests of the business of the Wagner company. In 1912, when the late S. M. Dodd was chosen chairman of the board, Mr. Layman was elected president and general manager to succeed him, and on the death of Mr. Dodd in 1913 he became also chairman of the board.

Like all manufacturing companies, the Wagner company has undergone vicissitudes in developing a well-rounded organization and a substantial line of products. Mr. Layman has not only played an active part in correcting the troubles of production and manufacturing, but it was he who led the company through the financial stress brought about by conditions following the war that were entirely outside of his own making. His dominating confidence in the character of the products his company has produced and the service which they render has stood as a bulwark for a business judgment which has won for him leadership as a chief executive.

Mr. Layman was born at Smithton Mo., in 1869, and was graduated from the Rose Polytechnic Institute in 1892 with the degree of B. S. In the fall of 1892 he entered the employ of the Wagner Electric Manufacturing Company as a utility man in testing and drafting work, and step by step he rose through the company's organization to be its executive head in 1902. From that time he has been the dominating figure in all of its affairs.

Mr. Layman is a fellow of the American Institute of Electrical Engineers, an associate member of the British Institution of Electrical Engineers, past-president of the Engineers' Club of St. Louis, past-president of the National Metal Trades Association, past-president of the Contemporary Club of St. Louis, member of the board of trustees of Washington University, member of the advisory board of the David Ranken, Jr., School of Mechanical Trades, member of the advisory board of the National Society for Vocational Education, member of the executive committee of the National Electric Light Association, member of the Engineers' Club of New York, the St. Louis Club, Noonday Club, St. Louis Commercial Club, City Club, Bellerive and St. Louis country clubs and the Round Table and Town and Gown clubs, the last named being a club of leading professional and business men.

Editorial Comment

Electrical World, December 9, 1922

Volume 80 Number 24

Special Fund for Highway Lighting

IN THE preparation of budgets for county and district highway expenditures for 1923, now under consideration in many sections of the country, men interested in better highway illumination should see to it that a special fund be set aside for this purpose. This should be done whether highway lighting be paid for directly by the counties or by districts such as are permitted by the laws of some of the states. Recent experiences have called attention to the difficulties that arise when appropriations are made from the general funds of the district. There is always a tendency in that case to spend the funds for something else, and in at least one case on record the treasury was so depleted two months before the end of the fiscal year that for the remaining period it was necessary to cut down highway lighting until the road was almost in darkness. No amount of arguing would convince the commissioners who had overspent their appropriations that this was a false economy.

The better method is to arrange at the time of the original contract that highway illumination shall be paid for out of a special fund set aside for that purpose and not to be used for anything else. Not only does this prevent use of the money for pet schemes of another character, but it also makes it possible to extend the lighting system at a later time without arraying against this plan all who have other ideas for the expenditure of the county or district funds.

This is not only a matter for the electric company in every community, but it also calls for action from the Commercial Section of the National Electric Light Association or local divisions of that organization. If these would go on record as favoring special provision for the payment for highway lighting, the action would have considerable weight both with some of the smaller companies, which are far from uniform in their practices, and with the county officials, who generally settle such matters on the basis of precedent.

Rebuilding Systems with Intelligence

BECAUSE of the nature of the growth of a district power supply nearly every system encounters the problem of consolidation and rebuilding at some stage of its development and is faced with the financial and engineering questions involved in insuring a unified system, cheap production and a secure future.

The article in this issue by William W. Handy outlines the method followed in an analysis of this problem as applied to conditions in the Pittsburgh district. It is a worth-while study and shows how accurately such problems can be solved if attacked with foresight fortified with field data. The very elaborate financial study involved in a study of the alternative solutions seems to have been warranted because the company wished to start on a basis of absolute knowledge that it was following the logical path of progress.

A great deal of interest should be aroused by the study of by-product plants in connection with the scheme. It would be valuable to get the exact reasons for deciding against this much-discussed type of development when it admittedly offered opportunity for cheapening power production. There is more to the matter than the disadvantages of a central station's attempting to operate several businesses. England has made many studies along this line and has produced some wonderful paper schemes, but no practical application of the ideas has resulted. More data are needed before a central station will embark on this new type of system. It almost seems worthy of government experimentation and research, because a successful by-product system would result in national fuel economies on a mammoth scale.

South Dakota Defeats Mobridge Project

JUST what the poll in South Dakota on the proposed hydro-electric development on the Missouri River at Mobridge means is rather hard to determine from an inspection of the vote. The proposal was defeated by 105,620 to 54,907, according to figures given out from Pierre on Nov. 21. However, it went down in a landslide of negative votes that overwhelmed five initiated laws and four constitutional amendments, none other of which had anything to do with such developments. Apparently the voters of that state made up their minds that an opposition vote was a safe one on any question. The friends of the project attribute the defeat to the state of the voter's mind, which was not favorable to the launching of any new enterprise. They declare that their plan will not be allowed to lapse because of this defeat and that "the best power site in any state in the Union will not be left unused for very long in the period of superpower and hydro-electric development that is now at hand."

Viewing the project against the sober background of the engineers' report, it will be apparent to the unprejudiced observer that the voters of the state are wise in their decision, regardless of the motive which may have inspired it. Though the project is not an impossible one, it is apparent that the cost of developing the site to a paying basis is one that would not afford a good commercial chance for private capital to take at the present time. It is equally apparent that in the hands of the politicians the development would be an expensive plaything for which the people of the state would pay a pretty price. The defeat of the initiated law will give every citizen further time to think over the proposition of handing such a plaything to the politicians. Regardless of the merits of the engineering features of the project, the people of South

Dakota should remember that there are many such projects that are desirable from a technical standpoint but as yet wholly impracticable commercially. The state can afford to engage in them only when the health and comfort of its people are at stake.

An Unusual Case in Industrial Power Design

THE tendency in recent years toward the use of alternating-current motors for practically all purposes has been so strong that the direct-current installation described in R. B. Stevens' paper in the current issue on the equipment of a sugar-refining plant affords a rather startling exception to the general rule of practice. The plant described is the refinery of the American Sugar Refining Company in Baltimore, one of the biggest and certainly the most modern of plants for treating cane sugar. Now, the fundamental of design as regards the layout of the entire system of machinery was to refine sugar cheaply while insuring the maximum continuity of operation and the greatest possible efficiency in the details of the process and at the same time depending on a low grade of labor.

In a sugar refinery the process from start to finish must be continuous and carried out at an even pace through all the departments if wastage is to be avoided and the final product obtained at a minimum price. In this particular instance, all things considered, it was found desirable to make the entire motor scheme of the plant a direct-current system, not on account of any particular fondness for direct-current machinery as such, but for certain very practical reasons connected with the chain of mechanisms which must be operated. About five hundred motors went into this great plant, aggregating nearly 8,000 hp. Most of the units are of rather low speed, and the driving shafts are often carried by silent chain or gear reducers.

The reason for so wholesale an application of direct-current motor units lies in the short distances of transmission, only a few hundred feet at most, and particularly in the frequent heavy starting loads and the great desirability, often a stern necessity, of speed variation at will. Sugar-refining machinery, carrying the material in process at a fairly high temperature, stiffens quickly after even a brief shutdown, so that the power required to start the machine may be ten times that required for operation when running in full use. The processes, moreover, being continuous and interdependent, must, if everything is to run smoothly from raw material to finished product, have their several elements capable of close adjustment in speed, unless there is to be large and expensive storage space between processes. Speed adjustment is definitely required or conspicuously advantageous in at least 80 per cent of the entire motor equipment.

Nothing can exceed the convenience and general effectiveness of a well-designed three-phase motor, but it is essentially a nearly constant-speed machine unless provided with slip rings and resistance, in which case it becomes the exact equivalent of a series-wound direct-current machine; but where facile change of speed is a prime necessity nothing has yet been devised quite so convenient as some of the adaptations of direct-current motor control. Here we have a case where the added complication and the higher first cost of the direct-current motor system showed itself decidedly worth while.

More Service Data Needed

A WEAK spot in the commercial routine of many central-station companies and manufacturing sales offices is the neglect of those closest in touch with new installation work to compile adequate performance data after such layouts become thoroughly "shaken down" into service. The industry is growing so fast that it is often most difficult to find time to put down these results before new demands absorb the attention of the sales engineer and the installation staffs. Yet, in the interest of escaping from rule-of-thumb imputations, something more must be done to reap this neglected harvest from the fresh fields of experience. The industry advances by leaps and bounds, and even the judgment of able engineers in close touch with commercial developments needs the reinforcement that significant service results offer.

Cost accounting has made great strides in factories during the past decade, and the rewards of a consistent policy of assembling and analyzing service data would be of the same magnitude if electrical men in touch with the economic performance of industrial heating, power and lighting installations would make a more concerted effort to pin down such information while it is fresh in mind or easily obtainable.

Plenty of descriptive information exists, but there is a serious lack of analytical data in the files of many central-station power engineering departments and of the sales offices of not a few manufacturers. If this statement is challenged, our columns are open to such material as contrary proof. We venture the assertion that in too many cases a search of the files will show bad gaps in economic information bearing upon service applications. Younger engineers in particular will do well to make a point of building up service data before these escape recording and analysis, and it is to be hoped that more and more information of the real "proof-of-the-pudding" type will be forthcoming for the benefit of the industry.

What Is the Source of Pin-Type Insulator Troubles?

WHAT is the trouble with high-tension pin-type insulators? The question is one that is agitating a great many central-station operators at the present time. There are no widespread troubles of an extremely serious nature that would lead any one to condemn present manufacturers or manufacturing methods, but there is a steady trickle of trouble that is a source of worry to both the manufacturer and the user. The trouble is typified by a tendency of insulators that have been in service for ten to twelve years to split, the top unit usually being the one to break. In some cases the petticoats break off. Although a large portion of the insulators that have given trouble seem to have been in service ten years or more, there are not lacking cases in which the insulators have been in service for only a short time.

In the discussion of the subject among operating engineers there is a decided tendency at the present time to blame the trouble on the cement used in the joints between members. Ordinary Portland cements in commercial use have a tendency to "grow" or increase in volume under the influence of repeated wetting and

drying. Moreover, if not properly treated in preparing, even the most thorough mixing cannot clear out some small particles that on examination will be found to contain dry cement in their interior. It is to be presumed that the insulator manufacturers have used the best practical methods of cement preparation they know. That this is the case is evidenced by the fact that the development of trouble is generally slow. There is good ground for believing that in the case of suspension insulators the manufacturer has been able materially to mitigate, if not entirely obviate, such troubles. There are methods of cement treating and setting that, it is claimed, remove entirely any chance of cement difficulties. Although such methods as are now known are likely to increase the difficulties of manufacture and also the price, it is not beyond the bounds of possibility that cheaper and better methods can be found.

Back of all the discussion is a real doubt as to just how far cement troubles play a part in the difficulties experienced. There may be other and bigger things involved.

No Place for "Complaints" and "Applications"

MUCH progress has been made in educating central-station employees away from the old "public be damned" attitude and the idea that a representative of a monopoly can be independent and indifferent in his relationships with the other people of the world. There still remain, however, several words in common use among utility men that have no proper place in the vocabulary of a public servant. One is "application" and the other is "complaint."

It is a bad thing for men to feel that the public has to come to them applying for something. The inference is that they by graciously granting these applications acquire merit, but as a matter of fact the utility man is not doing favors in responding to these "applications," for he is compelled by law to serve the public without discrimination. As a matter of fact, he is engaged in a business to make money like any other merchant, and these so-called "applications" are just orders from new customers whose business he is seeking. It would be well therefore to stop talking about "applications" and call them "orders," so that these new customers would be known by their right name and get the welcome they deserve.

As to "complaints," we question whether this word is not equally harmful and misleading to ourselves. "Complaint" has an ugly sound, for no one likes people who complain, and if a utility is treating its customers in the fair and friendly way that it should there ought to be no cause for complaints from any one. Things may go wrong, of course, and customers will report trouble, or short-sighted employees may be careless and unjust and the customer will and should appeal for help and redress. But no one need "complain" of anything that he knows will be made right as soon as it is reported. And if the service policy of any central station is as it should be there is no place for complaints. Let us banish the "complaint" window, therefore, and let the troubled customer come to the "information" desk and be referred to the proper executive.

It is all a matter of attitude. Therefore, for the influence it will have on both the public and the employee, let us put these cold-sounding words out of the official lexicon.

Higher Pressures and Temperatures in Central Stations

THE recent proposed increase of pressures in several power plants under construction brings to the front again the question of present economical limits and possible future developments as regards both higher pressures and temperatures. George Orrok, in a paper presented this week before the American Society of Mechanical Engineers, entitled "The Commercial Economy of High Pressures and High Superheats in the Central Station," points out that the limitations to temperature are set at about 750 deg. by available materials, but that manufacturers are prepared to deal with considerably higher pressures than any in use today in power-plant work. He shows, however, that the extra fixed charges largely offset the expected savings in fuel.

In considering higher pressures we must not lose sight of the fact that a large increase of pressure will result in a considerable increase of the loss by gas escaping from the boiler surfaces, making necessary the increased use of economizers or some other means of reclaiming heat from the flue gases after they leave the boiler. Economizers are barred if the multistage regenerating cycle is used in the steam and water circuit, and since this is the most efficient applicable steam cycle, our attention is at once directed to a plant utilizing some form of this cycle and having flue air preheaters installed to reduce the otherwise rather large losses from escaping gas.

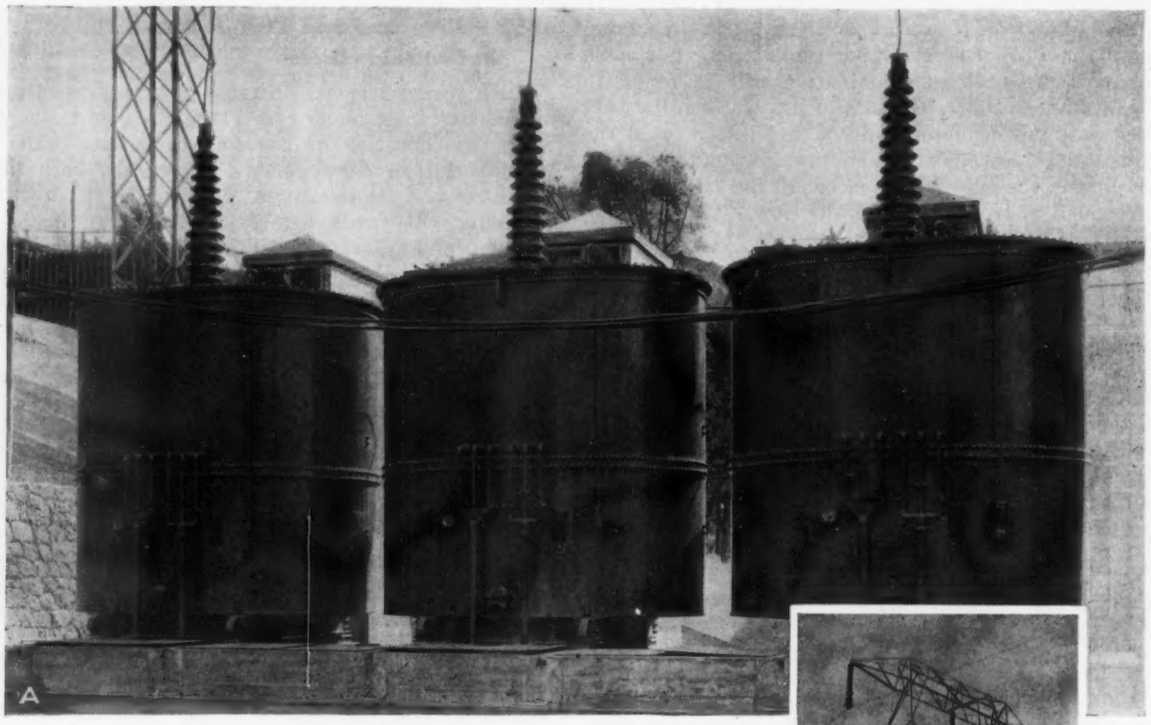
Flue air preheaters require large surfaces because the rate of heat transmission is low unless excessive draft losses are employed. Furthermore, they are not yet proved equipment, but in view of some recent installations, notably that of the Gennevilliers station of Paris, more information concerning their value may soon be available.

Should air preheaters prove impracticable, then it appears that it will still be advantageous to use some form of the regenerative cycle in which the feed water at fairly high temperatures, say between 300 deg. and 400 deg., enters an economizer. In short, there is probably some arrangement in which the modified regenerative cycle is combined with boilers having high-temperature economizers attached which will lead to the highest efficiency.

There is no question about the considerable gain in efficiency by the use of such arrangements at high pressures. At 1,200 lb. pressure it should be possible to save at least 25 per cent in the fuel bill. At such pressures the regenerative plant even without air preheaters or economizers should result in a fuel saving of 20 per cent as compared with heat-balanced plants.

The fixed charges appear as the economic obstacle to this development at the present time, but before coming to definite conclusions sight must not be lost of the facts that as more high-pressure equipment is developed its first cost, and hence the fixed charges, will probably decrease, that in the long run the price of fuel will probably increase, that as between two ways of generating power requiring equal effort and equal total expenditure that one is best which conserves the most fuel, and finally that high-pressure steam properly applied appears, even in the present undeveloped state of the high-pressure art, very nearly to hold its own.

The considerable saving in fuel which may be expected should encourage manufacturers to develop high-pressure equipment at a lower cost.

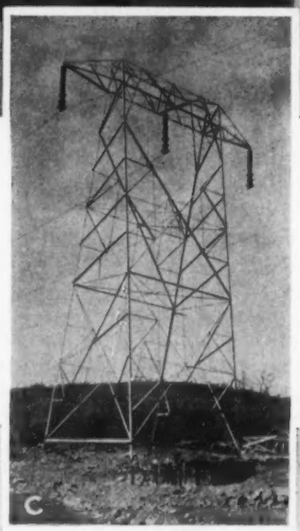


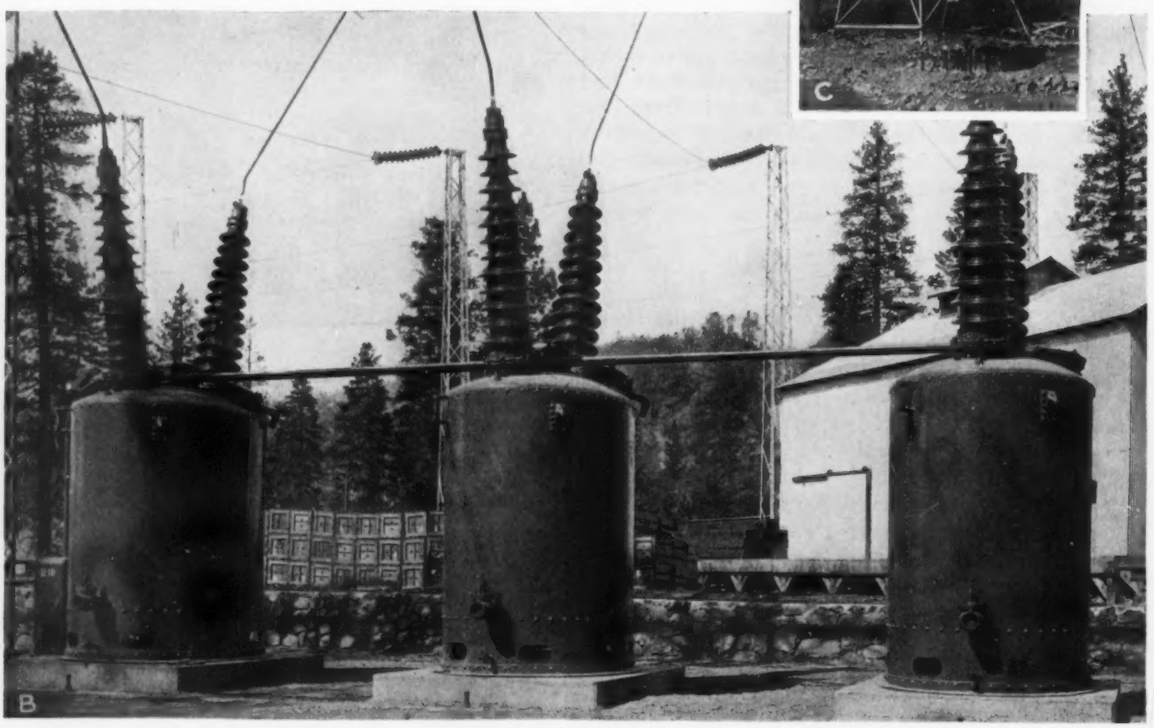
Glimpses of 220,000-Volt Equipment for Pit River No. 1 Line

A—Fifty-thousand kilovolt-ampere transformer bank at the Pit River No. 1 plant of the Pacific Gas & Electric Company, consisting of three 16,667-kva. units designed for 220,000-volt grounded-star operation. One terminal of each is grounded, thus necessitating only one high-tension terminal.

B—Oil circuit breakers for 220,000-volt line. Owing to the great weight of the moving parts they are inherently slow acting. A quick break is accomplished by means of an auxiliary contact.

C—Typical snow tower on 200-mile 220,000-volt line equipped with insulator strings consisting of nine standard disks and four special high duty units The special units are 10 and 14 in. in diameter, alternated at the line end of the string to break up the rain and thus increase the wet-flashover voltage. A 16-in. hollow copper disk below the lowest unit serves as a corona shield.





Voltage Limits in Impregnated Paper Cable

A Summary of the Technical Problems in the Manufacture of Cable and an Outline of the Present Methods for Obtaining Improvements

By WILLIAM A. DEL MAR
Chief Engineer Habirshaw Electric Cable Company

MAKERS of transformers, insulators and switching apparatus have successfully solved the problem of transmitting energy at more than 200,000 volts, but the cable makers have made no substantial advance since the 25,000-volt underground cables were installed at St. Paul in 1900. The entire industry is looking impatiently at the cable makers and asking why they are holding back the progress of underground transmission by their inability to keep pace with the makers of other devices. It is therefore a matter of prime interest to the electrical industry to examine the cause of this situation and to see whether any steps can be taken to help the cable makers out of their difficulties.

The designer of a high-voltage cable is limited at the outset by the maximum permissible diameter, which is usually 3 in. owing to the fact that the principal cities have large numbers of 3½-in. ducts installed. Even if larger ducts were used—and some cities are using 4-in. or 4½-in. ducts—the diameter of the cable could not be much over 3½ in. without making it too clumsy to install.

The limited diameter and the poor heat-dissipating quality of ducts make an installed cable a poor dissipator of heat. The heat that a 3-in. triplex cable can dissipate under these conditions is between 0.15 watt and 0.25 watt per foot per degree centigrade temperature rise.

Considering the problem of heat dissipation in greater detail, we find that the heat resistance from conductor to ground of a 25-kv. or 30-kv. triplex cable is made up, approximately, as follows, in percentages: Insulation, 82; sheath emission, 8; sheath to duct wall, 3; duct wall to ground, 7.

The heat resistivity of the insulation, which is the element in which the greatest room for improvement exists, is as follows, in degrees centigrade per watt-inch: Impregnated paper, 400 to 800; varnished cambric, 250 to 350; rubber compound, 250 to 350.

The big variations observed in each of these materials have been the subject of study by the National Physical Laboratory of Great Britain and numerous other agencies, but no notable progress has yet been recorded in increasing the heat conductivity of impregnated paper.

The emission of heat from sheaths varies from 150 deg. to 180 deg. C. per watt dissipated from each square inch of surface, depending upon the condition of the surface. No systematic attempt has been made to utilize this fact because of the practical difficulty of preserving any special surface on the lead during the act of drawing in the cable and while it is in service. The problem of the cable designer is therefore to transmit through the cable perhaps 20,000 kw. with a loss not exceeding the limited heat-dissipating ability described above.

The energy loss is partly in the conductor and partly in the insulation. Commercial copper has a conductivity of about 100 per cent of the annealed-copper standard. There is no better metal available at any price. Any improvement that may occur along this line must be due either to some lucky discovery or to research work of a fundamental character.

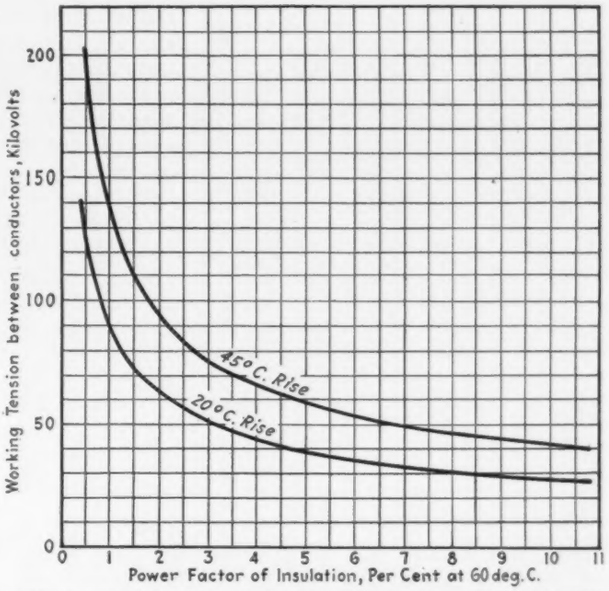


FIG. 1—VOLTAGE AT WHICH MAXIMUM CARRYING CAPACITY IS ATTAINED WITH VARIOUS POWER FACTORS

The insulation loss, on the other hand, has been the subject of considerable study. During the past few years the power factor of impregnated paper insulation has been reduced from more than 20 per cent to about 2 per cent at 85 deg. C. or 1.2 per cent at 60 deg. C. There is room for further improvement, and there is a prospect that the power factor will be lowered to well below 1 per cent at 60 deg. C. The dielectric loss, however, depends upon both the power factor and the specific capacity of the insulation, and no progress has been made toward lowering the latter.

The very highest temperature at which an impregnated paper cable could operate would be limited to about 135 deg. C. by the fact that insulation chars slightly above that temperature, but unfortunately other limitations come into play at much lower temperatures. One of the most serious of these is the permanent expansion of the paper and lead at temperatures above 60 deg. C., which results in the formation of voids in which vapor ionizes. Furthermore, the longitudinal expansion and contraction of cables in ducts leads to abrasion of the sheath.

This entire matter of temperature limits for cables is the subject of an exhaustive research now under way at the Massachusetts Institute of Technology. This research is being supported by the National Electric Light Association and is under the direction of the cable research committee of that society.

It is interesting to study in greater detail the effect of power factor upon carrying capacity. Let us assume a triplex cable 3 in. in diameter, of a commonly used conductor size, for use on a three-phase system with grounded neutral. Such a size would be 350,000 circ.-mil, sector shaped, and about the most effective insulation that could be applied within the diameter limitation would be 19/64 in. on each conductor and 7/64 in. over all.

There is given on page 2021 of Pender's "Handbook for Electrical Engineers" (edition of 1922) a formula for calculating the effect of dielectric losses upon the carrying capacity of a cable. If the symbol for dielectric loss in this formula be replaced by its equivalent in terms of tension, capacity and power factor, and if the symbol for current be replaced by its equivalent in terms of kilowatts, capacity and tension, a formula will be obtained expressing the carrying capacity in kilowatts in terms of the power factor and tension. This formula is as follows:

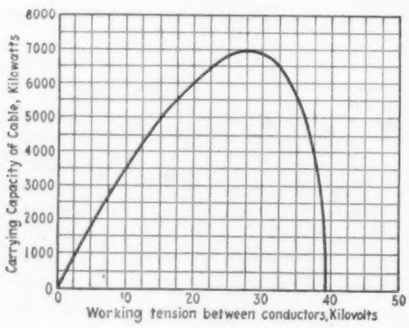


FIG. 2—CARRYING CAPACITIES BASED ON 10 PER CENT POWER FACTOR AT 60 DEG. C.

$$W = \frac{191}{\sqrt{r}} E \sqrt{\frac{T}{R} - 0.0159\, E^2 CP} \qquad (1)$$

where

W = power carried by cable, kw.
r = electrical resistance per 1,000 ft. of conductor.
R = heat resistance, deg. C. per watt-inch.
E = tension between conductors, kv.
C = capacity between any two conductors, the third being insulated, mfd. per mile if the specific capacity were unity.
P = power factor of insulation as a fraction.
T = temperature rise, deg. C.

It will be noted that E occurs in two places in the formula, first so that an increase in it will increase W and then so that it will decrease W. There is, therefore, a certain value of E which makes W a maximum, and this occurs when

$$E = \sqrt{\frac{T}{0.0318\, CPR.}} \qquad (2)$$

Let us take the following values for our cable, assuming the specific capacity to be 4:

T = 20 deg. C. (= 60 deg. final — 40 deg. ambient).
C = 0.05.
R = 163.
r = 0.035 at 60 deg. C.
P = 0.1.

Then a graph of equation (1) will be as shown in Fig. 2, which clearly shows the maximum point referred to above. This maximum point occurs at about 28 kv. for the power factor assumed. For lower power factors the voltage corresponding to the maximum carrying capacity will increase, and for higher power factors it will decrease, as shown in Fig. 1.

Most of the old resin oil cables had power factors as high as 25 per cent at 60 deg., and in this case the maximum carrying caapcity in kilowatts would be attained at less than 18 kv. per conductor. At 40 per cent power factor, which was not at all unusual in the cables of twenty years ago, the maximum carrying capacity occurs at 14 kv. It is therefore very doubtful whether the early high-voltage installations could be justified.

When all problems relating to temperature have been solved, there remains the problem of dielectric strength. In other words, power factors being below 2 per cent at 60 deg. C., there is no reason, as far as average heating is concerned, why tensions as high as 60 kv. cannot be used. The problem resolves itself, therefore, into eliminating the local heating which causes electrical breakdowns. This problem is being attacked with great vigor by K. W. Wagner, H. J. Ryan, C. P. Steinmetz, J. L. R. Hayden and some of the cable manufacturers.

The dielectric strength of insulation is a subject that is complicated by the almost unavoidable presence of air or vapor spaces in every solid or liquid insulation. In cables this complication is unusually serious owing to the necessity of a high degree of flexibility in all cables.

At the present time the breakdown voltage of solid or semi-solid insulation in relation to its thickness and the electric field distribution within it is not clearly understood. This problem has been solved for air and oil, but not for the materials used as cable insulation. Until it is solved the voltage which a cable will stand cannot be accurately predetermined from the dielectric strength of its insulation. This subject was discussed at some length at a symposium held at the June, 1922, convention of the A. I. E. E., but the problem was by no means solved.

One of the problems that requires careful consideration is whether the European practice of using round conductors and thin insulation is as good as the American practice of using sector conductors and thick insulation. The arguments in favor of the European practice are that there results less cracking of paper with round than with sector conductors, better impregnation due to the smaller amount of paper, and less liability to hot spots.

A general view of the situation as outlined above is afforded by the following table:

	Limitation	To be Raised or Lowered	Agencies at Work Other than Cable Manufacturers
1.	Diameter	R	.....
2.	Heat resistivity of insulation	L	Nat. Phys. Lab. & N.E.L.A.
3.	Heat emissivity of sheath	R	.....
4.	Heat resistance of ducts	L	.....
5.	Electrical resistivity of conductor	L	.....
6.	Power factor of insulation	L	.....
7.	Specific capacity of insulation	L	.....
8.	Temperature limits of cables	R	N.E.L.A.
9.	Dielectric strength of insulation	R	Several noted physicists
10.	Dielectric strength of splices	R	.....
11.	Dielectric stresses in insulation	L	.....

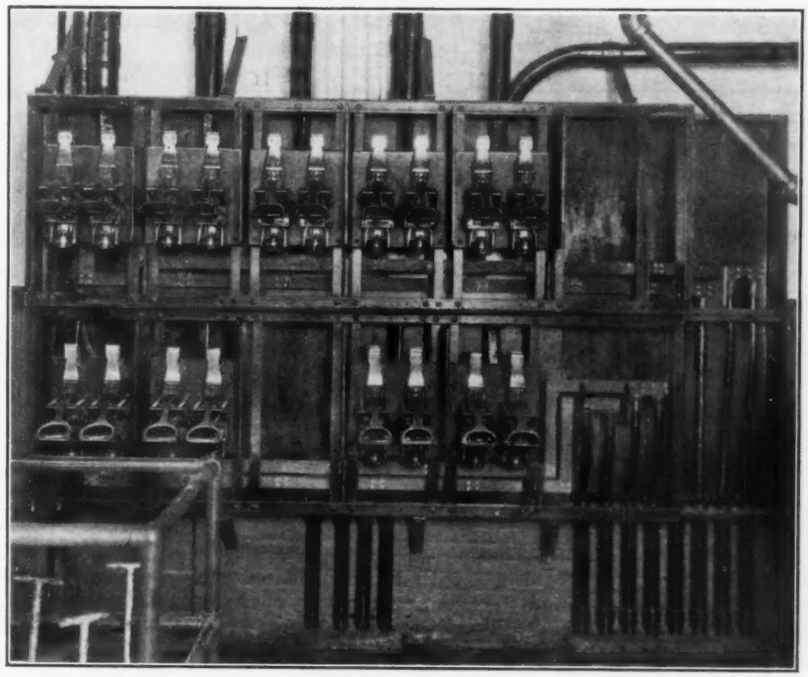
In addition to the above agencies of research, an important committee has been organized under the auspices of the engineering division of the National Research Council to deal with insulation problems in a general way. This committee is under the chairmanship of Prof. J. B. Whitehead of Johns Hopkins University and is now seeking the co-operation of all those who are interested in insulation problems. Suggestions as to phases of the problem and directions of approach or any hints of a helpful nature will be greatly appreciated by this committee. Furthermore, those who are carrying on research work on insulation will find this committee a splendid clearing house through which to exchange information and prevent duplication of effort.

Factors in Industrial Plant Distribution

Operation at Minimum Cost and with the Greatest Continuity of Service Obtainable with a Small and Inexpensive Force Was the Major Consideration in Designing American Sugar Refining Company's New Plant

By ROGER B. STEVENS*
Consulting Engineer, New York, N. Y.

MINIMUM operating expense and the highest dependability of operation obtainable with a small and inexpensive operating force were the major requirements in selecting and laying out the electrical equipment of the recently completed Baltimore plant of the American Sugar Refining Company. The operating and maintenance conditions particularly were kept closely before the designers, and in cases of conflict between standard power practice and process requirements there was no hesitation in departing from precedent in order to improve the operation and make feasible the object for which the refinery was built—namely, to refine sugar cheaply. Of particular influence were the low grade of labor to be utilized, the likelihood of damage to product from stoppage of any machine in the process chain, the possibility of having to change machine speed, and the necessity of providing for 25 per cent increase in power facilities. Aside from being the most modern cane-sugar refining plant in the world, this installation is interesting because direct current is used throughout, because of the very complete protection of live parts by conduits and steel cabinets, and because of the extensive use of individual motors and motor circuit breakers in place of fuses. Approximately 500 motors are installed aggregating 7,900 hp., the largest being rated at 300 horsepower.



MOUNTING AND ARRANGEMENT ADOPTED FOR PANHOUSE BRANCH LINE CIRCUIT BREAKERS AND THEIR CONNECTIONS WITH RISER CABLES

CONDITIONS DICTATED USE OF DIRECT CURRENT

In view of the very general tendency in industrial-plant design toward alternating-current application, the adoption of direct current for such a large and extensive plant may seem reactionary. It was, however, made only after a thorough and exhaustive analysis of the problems to be met and of the relative advantages to be obtained from the two systems of transmission and application. The reasons underlying the decision can best be explained by briefly outlining the problems to be encountered:

The sugar refinery consists of a number of connected or closely grouped buildings, the transmitting distances are short and the loads closely concentrated. In nearly all cases the refining equipment offers a very high resistance to starting, as the material in process has a tendency to harden and stiffen after a brief shutdown. The power required to start a given machine may thus be from five to ten times that required for operation after the running condition has been reached. Nearly all of the refining processes are interdependent and continuous. Hence, if excessive interprocess storage space is to be eliminated, it is necessary that the speeds of the various conveying units be capable of close adjustment. Furthermore, in the case of more than 80 per cent of the total horsepower required, either a speed adjustment was absolutely necessary or a very distinct advantage was to be gained by providing such adjustment.

RELATIVE MERITS OF DIRECT AND ALTERNATING CURRENT

In comparing the application of alternating current with direct current the following important characteristics stand out: the extreme simplicity of the squirrel-cage motor, with its complete freedom from moving electrical contacts and light breakable metal parts; its low first cost; greater efficiency of electrical transmission at distances where direct-current transmission is out of the question; the fact that the voltage applied to motors may be raised to a point which would be dangerous in an installation where the motors have open commutators and brush rigs accessible to the class of labor used. Against the use of alternating current are the following considerations: The squirrel-cage motor

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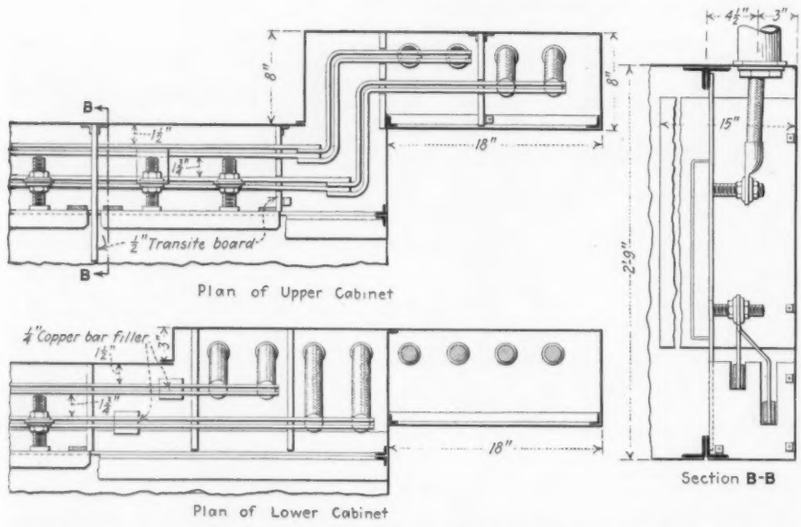
is inherently a constant-speed device; its starting torque is low; its power factor is greatly reduced at less than full load. The slip-ring motor partially overcomes the first two of these difficulties, but in an unsatisfactory way because it introduces the disadvantages of moving contacts and vulnerable brush rigs.

In favor of the direct-current system we have the following facts: Practically any desired range of speed adjustment or torque characteristic is possible; whatever the load, the power plant and system obviously operate at unity power factor and without the great drop in efficiency experienced with underloaded alternating-current equipment. Opposed to the direct-current system are the added complication and slightly higher first cost (horsepower for horsepower) and the less efficient transmission at great distances.



PLAN OF BUSBAR CONNECTIONS TO RISER CABLES (SEE ELEVATION ON PAGE 1259)

When applied to refinery conditions a decision between the relative advantages of direct current and alternating current must therefore be almost overwhelmingly in favor of direct-current operation. Compared with the higher starting torque and adjustable speed of the direct-current motor, the slightly higher first cost is negligible. When the necessity for greatly overmotoring the alternating-current drives in order to provide sufficient starting torque is taken into account, the first cost of the equipment is lower, if anything, for the direct-current than for the alternating-current system. In this particular case transmission is well within the economical range of direct current at 240 volts, the average weighted transmitting distance being 232 ft.; 1,050 kw. was transmitted 325 ft. to the pan and finishing buildings with a voltage drop of only 2.1 per cent, and 150 kw. was transmitted to the cooperage, or a distance of 800 ft., with a voltage drop of only 2.8 per cent.

While the voltage (230) used in the direct-current system is lower than would have been used in an alternating-current system and heavier individual cables were used, the total cost of the distributing system is lower. This is principally because of the advantage which is taken of the closely concentrated loads in grouping a large number of motors on single feeders to take advantage of the low diversity factor thus obtainable. With an alternating-current system the three wires of a three-phase system must be run together, and physical limitations preclude the use of feeders of as large capacity as may be used where the direct-current cables are run in separate ducts. Running the positive and negative conductors in single cables and separate ducts and grouping the conductors in multiple to form single-feeder circuits of large capacity allowed full advantage to be taken of the motor-grouping possibilities in cutting down the total copper installed.

To enable segregation of the bus in case of trouble and to facilitate repair work the main bus serving the refinery is provided with removable sections. Each power-feeder breaker is equipped with overload and direct-acting inverse-time-limit features, and permanently attached operating handles are provided for use in the very remote contingency of interruption in the control circuits. No locking devices are used on the disconnecting switches because it was not believed that the stresses under short-circuit conditions would be sufficient to open them. This has been proved true in the case of two practically dead short circuits on the heaviest feeders since the plant was completed.

All of the feeders run to the various centers of distribution through underground conduits. Special precautions had to be taken in designing this part of the system because the ground consists almost entirely of a fill covered with a concrete pavement, which in many places must withstand the weight of railroad tracks and the company's heavy trucks. Furthermore, the heat absorbed by a pavement exposed to a Baltimore July sun is intense. The construction adopted consisted of 3½-in. fiber conduits laid in two layers on 6-in. centers and inclosed in a reinforced-concrete envelope. Under the building these ducts lie directly on a 3-ft. mat which supports the buildings. Between buildings a self-supporting bridge structure was built of reinforced concrete strong enough to allow the ducts to be led through it and at the same time to support the weight of the shallow earth fill, the concrete pavement and the superposed live load of trucks and railroad equipment. Opportunity was afforded the ducts to slide over the top of the mats to compensate for expansion and contraction due to temperature changes.

The signal circuits are also run in the concrete envelope with the light and power feeders, but are inclosed in iron conduit and segregated in one corner. At terminal points and cable pits the light and power ducts are either carried to separate cable pits or separated from the signal circuits by a substantial concrete wall. All cables are protected with a double wrapping of asbestos fireproofing tape impregnated with sodium silicate.

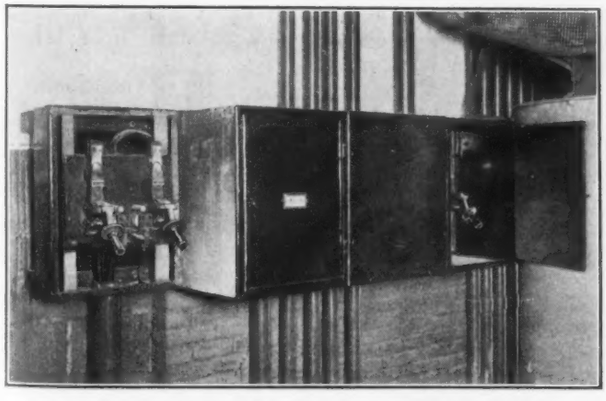
PAPER-INSULATED CABLE USED UNDERGROUND

All underground cables except the small multi-conductor control and signal cables are paper-insulated. For interior work cable insulated with varnished cambric and covered with two flame-proof braids was used. Paper was chosen instead of varnished cambric for the underground cables because of its ability to stand up under severe temperature conditions and because of

its lower first cost. Because of the conditions outlined previously and the fact that practically the entire space between the buildings is filled with duct lines separated from the pavement by only a shallow earth fill, all underground cables have been very conservatively rated. In all cases that part of a feeder which lies underground has been given a greater cross-section than the part in the interior conduits; in some cases the difference is nearly 100 per cent.

In several cases two cables were used in multiple to form a single heavy feeder. This was made necessary for several reasons. First, owing to the difficulty of using larger sizes, cables of 1,500,000 circ.mills cross-section were established as the largest size to be used. Aside from the weight and rigidity of the larger sizes, the fact that a paper and lead cable cannot safely be bent to a radius of less than twelve diameters, and that interference with water, steam and sewer lines made very long radius bends almost impossible, prevented the use of heavier single conductors. Second, a definite advantage was to be gained from better diversity factor by serving as many motors as possible from a single feeder. Both of these considerations pointed to the desirability of combining the carrying capacity of two cables in one feeder. Care was taken to have the cables of equal length within pairs, and at every point where a tap was taken off a full-size equalizer connection was made, so that unequal division of load and consequent overload and heating are not expected.

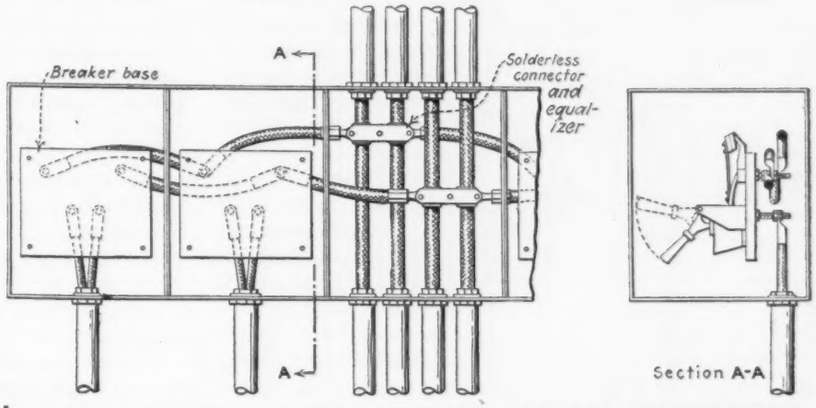
While the refinery, as constructed, is designed for two-thirds of its ultimate capacity, provision has been made for the 50 per cent expansion. Enough preliminary data were obtainable to make it possible to proportion the feeders, ducts and layout with this in view. Duct lines have been installed throughout in sufficient number to take care of the ultimate cable requirements and to leave at least 25 per cent spares in all cases after the last cables have been installed. No spare cables will be pulled into the ducts at present, as in case of trouble it will require only a couple of hours' work to pull into service a new feeder into any building. A length of No. 10 iron wire has been pulled into each vacant duct to facilitate the pulling in of future cables. When expansion is finally made it will only be necessary to install one additional circuit breaker in the space provided and on supports already installed, and to pull in one additional feeder to each building affected. The additional feeder and breaker in each case will be the same size as those already installed.



CABINET ADOPTED TO HOUSE ALL CIRCUIT BREAKERS

SPECIAL DISTRIBUTION BOXES USED

Each feeder is carried full size straight through to the last floor that it feeds. The installation and connection of feeder taps and branch circuit protective devices have been greatly facilitated by the use of shallow steel wiring chambers bolted to the wall on each floor so that the riser conduits enter at the bottom and leave at the top. These boxes leave the cables easily accessible and allow them to be wedged for support at each floor. Similar boxes are installed alongside the riser boxes for each branch floor-feeder circuit. All boxes are drilled on the sides where they abut and clamped together with short nipples. In all except the riser boxes steel frames are placed to support the slate panels upon which the branch circuit breakers are mounted. Solderless clamp connectors fasten the cable taps to the risers and provide equalizer connections in the case of multiple feeders. Taps are led off to boxes in both directions wherever more than one branch-feeder circuit is installed.



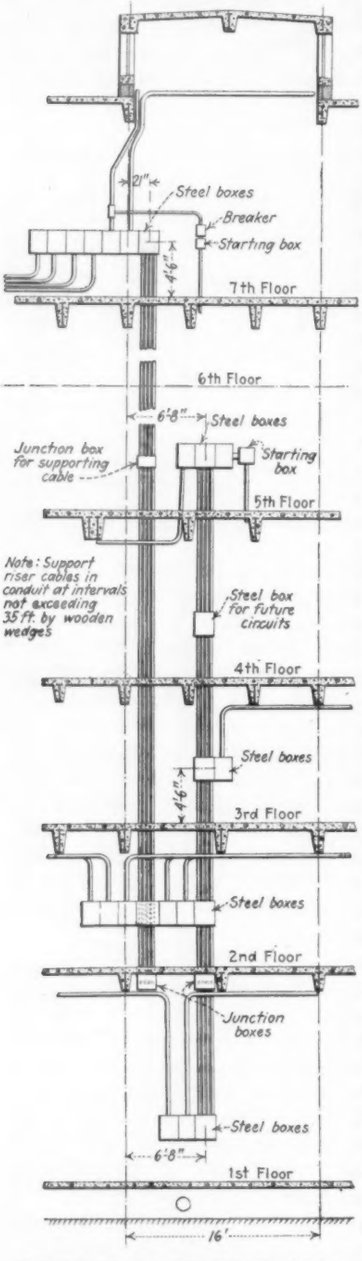
METHOD OF CONNECTING MULTIPLE RISERS WITH BRANCH LINE CIRCUIT BREAKERS

All branch-feeder circuit breakers are purchased mounted on slate panels of uniform size, and the steel frames which support them in the boxes are likewise drilled uniformly. Where a large number of breakers are installed together the abutting sides of the boxes are entirely cut away, transite board barriers with slots substituted, and all connections between risers and breakers made with bar copper instead of with cable jumpers. Connections are made to all of the breakers, which are back-connected before they are installed.

The riser boxes are provided with plain screwed covers, while the breaker boxes have the hinged front, thus making them easily accessible for operation, repair or extensive adjustment. The deep-front sections of the riser boxes serve no purpose except to bring all the work into symmetry, give a uniform appearance and form a convenient receptacle for the protection of instruments when extensive test readings are to be made.

A departure was made in caring for the branch circuit serving the centrifugal-machine floor of the pan-house. Here there are forty-eight centrifugal syrup extractors, each driven by a motor which is nominally rated at 20 hp., but which is started by being thrown directly on the line with only a small limiting resist-

ance in series so that the momentary starting current is approximately 250 amp. These machines are served in groups of six to eight with a branch feeder and circuit breaker for each group. Wall space is limited so that it was necessary to place the breakers in two horizontal rows, one above the other. To take care of this condition the cabinet shown on pages 1259 and 1260 was designed. The two feeders which serve this floor enter the shallow part of the cabinet from below at the righthand side where they are attached to the distributing bus by lugs. One feeder serves the upper row of breakers, and the other feeder the lower row. All breaker connections are made with bar copper and the breakers are easily removable or interchangeable. The fact that a riser for the floors above had to pass at the point where the cabinet was installed made the design of the cabinet slightly more difficult, as it was necessary to allow space behind it for the passage of the four conduits carrying this riser. While apparently a rather expensive piece of equipment, this cabinet was built at somewhat less cost than the number of standard individual breaker cabinets which it supplants. It was constructed by a contractor who did a great deal of sheet-metal work in the plant. The copper-bar work was all done by the electrical force in the plant. From the branch circuit breaker boxes the floor feeders usually leave through the bottom and pass down through the floor to a point under each motor. As many motors as convenient are connected to each branch feeder, the largest feeder capacity being 600 amperes.



TYPICAL RISER SECTION, SHOWING BOXES THAT FACILITATE TAKING OFF BRANCH CIRCUITS

To avoid running the taps to the motors and breakers the same size as the floor feeders, as would be required under the code unless a cut-out of some kind were installed immediately at the point of tap-off, special permission was obtained from the local inspection bureau to use taps of motor-size cable not longer than 15 ft. without the installation of cut-outs, provided no wire smaller than No. 4 were used in the taps. This permission was obtainable in view of the high class of construction employed and the safeguards applied to the equipment.

Every motor has been equipped with some form of conduit terminal box which allows the cable to enter the motor frame without breaking the continuous chain of conduit protection. The rigid conduit from the branch circuit feeder, terminating at the motor base, is equipped with an end bushing and clamp, and the final run of 18 in. to 3 ft. is made in flexible metal conduit which enters the cast-iron and steel terminal box on the motor frame directly.

All manual starters and field rheostats of the faceplate type are equipped with safety covers which entirely obviate the possibility of accidental contact with live metal parts, only the insulated operating handles projecting through the covers. Automatic and remote-control equipment, where used, is installed in steel cabinets with provision for locking should operating conditions warrant the necessity.

The factors influencing the selection and installation of motors and control equipment will be discussed in a later issue.

Present-Day Electrification

ALTHOUGH no power census is available in Great Britain, data are gradually being accumulated concerning some of the larger spheres in which power is produced. In this connection the summary concerning the electricity stations in Great Britain which was prepared recently is welcome. The return covers 421 generating stations belonging to authorized undertakings as well as eighty others that send in voluntary returns. Of these, 463, consuming coal or coke, generated nearly 5,000,000,000 kw.-hr., with a consumption of 7,356,757 tons of coal or coke, or an average figure of 3.32 lb. per kilowatt-hour. The lowest coal consumption recorded is 1.70 lb. per kilowatt-hour at works in the southwest counties that generated under 3,000,000 kw.-hr. The best thermal efficiency reported is approximately 17.75 per cent, obtained by a large station in Northumberland.

Waste-heat stations produced over 161,000,000 kw.-hr., oil engines nearly 24,000,000 kw.-hr., refuse destructors nearly 18,000,000 kw.-hr., water power less than 5,000,000 kw.-hr., and gas engines approximately 4,000,000 kw.-hr. for the year ended March 31, 1921. The thermal efficiencies of the stations using oil cannot be stated because they did not specify the quantity of fuel used.

In general these figures cannot be held to be very creditable, at least from a thermal point of view. If coal conservation is to be a live issue, they should be improved considerably. On the other hand, doubtless any drastic reduction in the coal used would compel an outlay of more capital than the financial savings to be effected would recoup. The figures support the contention that the larger power stations are more economical, as was to be expected, but the average figure of 2.71 lb. of coal per kilowatt-hour generated in the twenty stations with outputs over 50,000,000 kw.-hr. is still capable of great improvement. In fact, many small private plants using gas engines can easily beat that figure. Moreover, it is obvious that a supply from a station using coal at that rate could not possibly compete with a private plant where heating is also required.

Superpower Study in Pittsburgh District

Selection of Type and Location of Generating Stations — Economics of Bulk-Power Production and Distribution — Comparative Data and Solutions of the Problems Encountered in the Course of Investigation

By WILLIAM W. HANDY
Consulting Engineer, Baltimore, Md.

ABOUT ten years ago, prior to the beginning of the great war, some studies were made by the writer of this paper and other engineers, under the general supervision of Charles F. Uebelacker of the engineering firm of Ford, Bacon & Davis, to determine the most economical plan for the generation and distribution of electric power in that part of western Pennsylvania known as the Pittsburgh district. The work was undertaken originally for the Pittsburgh Railways Company and the Allegheny County Light Company, which at the time furnished street-railway and electric light and power service in Pittsburgh and Allegheny County, both companies being controlled by the Philadelphia Company, which, in addition to the street-railway and electric light and power systems, controlled certain natural and artificial gas supplies of the district as well.

While the final development of the system as it now exists, with certain modifications determined from more recent studies, was made under the supervision of engineers other than those making the original studies outlined in this paper, the plans ultimately carried into effect agree very closely with those proposed in the original investigation, indicating careful analyses and sound conclusions on the part of both bodies of men engaged on the work.

Existing Conditions in the Pittsburgh District

As a whole the situation affecting the generation and distribution of power which confronted the original investigators did not differ very materially from that which existed in other large centers of population, owing to the fact that the existing system was composed of a number of consolidated street-railway and electric light and power properties, with the consequent undesirable duplication of certain parts of the systems, such as generating stations, and the further complication, which invariably arises, that under certain of the mortgages applying to the original bond issues property could not be abandoned or sold without legal steps to protect the bondholders' interests.

All of the details requiring investigation cannot, of course, be presented in this paper, but the major factors will be brought out as far as possible. Chief among these were:

1. The railways company was generating its own power and distributing it to its substations or to the 600-volt feeder system direct, mostly from small and inefficient generating stations located haphazardly as regards the system development.

2. The light and power company, while it had two fairly efficient generating stations, had others that were as inefficient as the railway stations.

3. There was no general plan in effect whereby the generation and distribution of power for both railway and light and power purposes was from one central source or sources under the management of an organization whose sole business it was to generate and distribute power at the lowest possible cost.

Street-Railway Power

The most advanced modern practice at the time was for street-railway companies to obtain power where possible at the high-tension buses of their own substations or at the low-tension buses of light and power substations under contracts below the costs at which they could manufacture their own power, thus leaving the railway companies free to devote all their efforts to the business of transporting passengers. Studies were made of existing systems in other cities as well as in Pittsburgh of the several contracts for the purchase of power by street-railway companies, and after a thorough analysis of these data it was apparent that a contract could be entered into between the Pittsburgh Railways Company and the Allegheny County Light Company whereby power could be bought for all street-railway purposes by the former from the latter company at terms satisfactory to each, which would result in a sufficient saving in power cost to the former company and a sufficient profit to the latter to warrant fully putting the plan into effect. A contract carrying out this plan was drawn up and executed, one of the provisions of which was the taking over of the railway generating stations and their operation by the light and power company at certain purchase prices based on actual costs less depreciation, the purpose of the light and power company being to continue to operate certain of the more efficient railway generating stations and to discontinue operation of the others.

Industrial Power

During the time that the above study was being made of the railway power situation another study or survey was under way covering the requirements for industrial power in the Pittsburgh district with a view to ascertaining the quantities and location of the industrial power demand both at the time of the survey and as estimated for future years. An organization was built up for this study, and men were sent into the field to visit all industrial plants which used or might use central-station power and to ascertain in addition to the quantity of power required for each establishment the characteristics of the load, including present costs of power to the industries, amount and time of peak load, number of hours' use and the load factor. Power surveys such as these have been made in practically all industrial centers by the light and power companies, but while there was nothing new about the one made in Pittsburgh, it was of especial importance in view of the fact that a very small amount of central-station power was sold at the time in comparison with the enormous volume of industrial work

carried on in the district and the apparently very large revenue to be derived from this source if the industrial establishments could be persuaded to buy central-station power. To sell this power it was necessary, of course, to insure absolute continuity of service and a cost considerably below that at which the industries were generating their own power. The result of these industrial power survey studies indicated that an enormous demand for electric power existed in the Pittsburgh district and that in order to secure it in large quantities it was absolutely essential that the cost of generating and distribution by the power company be at as low a figure as the most advanced development of the art would permit. This meant that old inefficient generating stations must be replaced by modern ones and that the more efficient of the existing stations must be enlarged and improved so as to produce power at the lowest possible cost.

FORMATION OF POWER COMPANY

Based on the studies made of the immediate and estimated future requirements for street-railway and industrial power, the peak demands and the location of certain large blocks of power required for industrial purposes, it became evident that under the existing charter of the Allegheny County Light Company power could not be furnished to certain sections of territory outside of Allegheny County. In view of this fact charter modifications became necessary. It was found that a small independent light and power company, known as the Duquesne Light Company, operating a natural-gas engine station in the East End of Pittsburgh, was not only a competitor in the power market to a sufficient extent, considering possibilities of future extensions of operations then under consideration, to warrant the purchase of its plant and charter and franchise rights, but that the charter of the company included certain privileges as to enlargement of territory served outside of Allegheny County which were lacking in the charter of the Allegheny County Light Company and which embraced all the additional rights that the latter company required in order to enable it to furnish certain large blocks of power in sections outside of the boundaries of Allegheny County indicated by the power survey. Negotiations were therefore started for the purchase of the Duquesne Light Company and were consummated soon afterward, and since the date of purchase operations have been carried on under the name and charter of the Duquesne Light Company. The new company is primarily a power company, and while it does retail power wherever necessary in the territory covered by its charter, its fundamental purpose is to generate power at the lowest possible cost and sell it on a wholesale basis.

Careful analyses were made to determine whether or not the existing generating stations should be continued in service or their operation discontinued, these analyses comprising two comparisons briefly described as follows: First, a comparison for each station of the total annual cost of carrying its present load and the estimated cost if the station were discontinued and the load carried by a substation operated with high-tension power; second, a comparison for each station of the total annual cost for peak-load service alone, as compared with the total annual cost of carrying this same peak on a substation operated by high-tension power.

Under the first comparison the cost of operation and maintenance of the old station, together with fixed charges including interest at 10 per cent on the existing salvage value, made up the total cost of production, while the cost with substation power was made up of the operation and maintenance of substations, transmission lines and new generating-station equipment, together with the fixed charges on the investment for these items, including interest figured at 10 per cent. Interest in both cases was taken at 10 per cent on the assumption that it would not pay to replace the present stations unless at least 10 per cent could be earned on the new investment required. The result of these comparisons for the existing total loads indicated that out of a total of nine generating stations all should be discontinued with the exception of three known as Brunot's Island, Rankin and Twentieth Street, the two former being alternating-current and the latter a 600-volt direct-current railway station.

Similarly, under the second comparison for peak-load service only, the analyses included the same comparison of power costs—including operation and maintenance costs of the old station, together with fixed charges, including interest at 10 per cent on the existing salvage value—and costs with substation power, made up of operation and maintenance of substations, transmission lines and new generating-station equipment, together with fixed charges on the investment for these items, including interest figured at 10 per cent. In addition, for peak-load service, the second comparison included the preparation of two curves for each station by years up to and including 1918, one curve giving the costs of power for peak-load service by years with the old station, taking into consideration the estimated growth in peak demand, and the other curve giving the cost of power for the same peak-load service by years for substation power. In those cases where the curve for the old station was entirely above the curve for substation power the old station should be discontinued, but where the curve was below that for substation power or crossed it the old station should be continued in service to the date indicated by the point where the curves crossed, and at that date operation of the old station for peak-load service should be discontinued.

The result of these two comparisons indicated that for the period considered from 1913 up to and including 1918, out of the total of nine generating stations, the three stations known as Brunot's Island, Rankin and Twentieth Street should be in operation in the year 1918; that two stations known as Thirteenth Street and Glenwood should operate until about April, 1916; that one station known as the Duquesne gas station should operate until April, 1914, and that three stations known as Manchester, Thirtieth Street and Suburban should operate not later than the end of the year 1913, or, in other words, be discontinued immediately when substation power could be substituted.

SELECTION OF TYPE OF PRIME MOVERS

Estimates were prepared covering investment and production costs, comprising operation and maintenance expenses and fixed charges on the investment involved for typical sizes of certain types of stations without reference to location, except that they should be in Pittsburgh, and exclusive of the cost of land and the cost of substructure below the basement floor. Of such stations built in Pittsburgh there were three kinds possible—(1) steam stations using coal for fuel with the coal purchased and exclusive of ownership of coal mines; (2) steam stations using natural gas for fuel with the

gas purchased from the existing natural-gas system supplying Pittsburgh, and (3) internal-combustion-engine stations using natural gas purchased from the existing natural-gas system. The typical sizes of stations selected for analysis were rated at 40,000 kw., 75,000 kw. and 140,000 kw. for steam stations using coal for fuel, at the same figures for steam stations using natural gas for fuel, and at 15,000 kw. and 30,000 kw. for internal-combustion-engine stations using natural gas. It will be noted that the internal-combustion-engine stations using natural gas were of smaller size in the above comparison than the two other types of station. This was because a larger size than 30,000 kw. was considered impracticable owing to the comparatively small size of the internal-combustion engines then on the market, and because it would be better and more conservative, in view of existing practice in stations of this type, to have four or five of these stations at various locations than a single large one at one location.

From the comparison it was evident that the steam station using coal for fuel had a decided advantage over the two other types, the production costs per kilowatt-hour being on the average for the three load factors considered about 48 per cent higher for the steam station using natural gas for fuel than for the steam station using coal for fuel, and the production costs for the internal-combustion engine stations using natural gas about 23 per cent higher than the costs for the coal-fuel steam station. In view of these production costs for the types of station selected for comparison, both the steam and internal-combustion-engine stations using natural gas purchased from the existing natural-gas system were eliminated from further consideration.

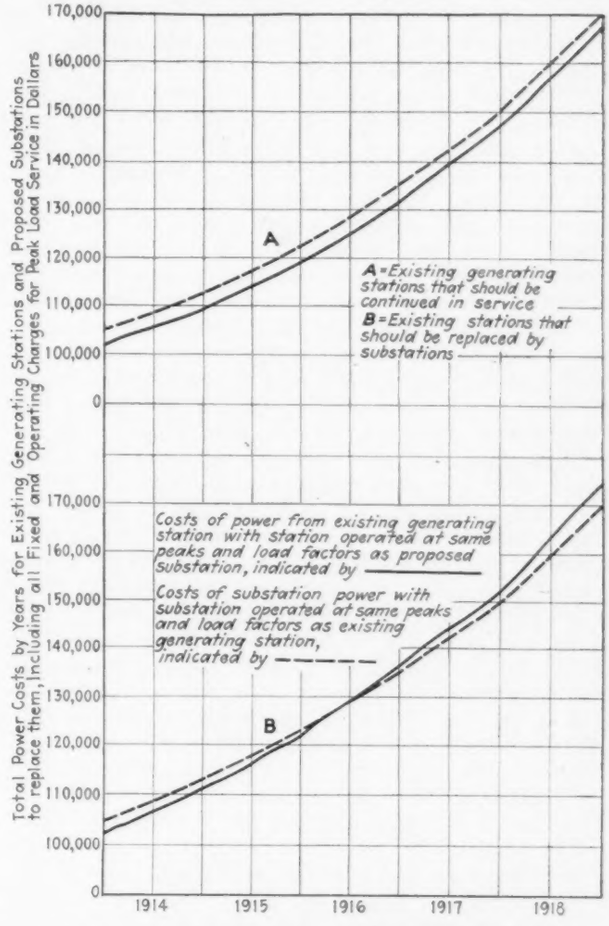
Stations at existing locations and new ones at certain selected sites, including hydro-electric stations, together with steam stations using coal for fuel where there was ownership and operation of coal mines, byproduct coke-oven gas stations, etc., were omitted in this analysis, owing to the fact that the costs of producing and delivering power could be estimated for them only at fixed locations.

SELECTION OF TYPE AND LOCATION OF STATIONS

After the elimination from further consideration of steam stations and internal-combustion-engine stations using natural gas purchased from the existing system and located in Pittsburgh, the next step was to determine the costs of production and delivery of power from existing stations which it had been determined should remain in service and the costs of production and delivery of power from all types of new stations at various sites selected as feasible. For these purposes an organization was perfected and men were assigned to make the investigations to be described.

Steam Stations Using Coal for Fuel at Existing Locations.—Costs were determined for production and delivery of power from the two largest and most economical of the existing coal-fuel steam stations of the company, which it had been determined should be continued in operation—the station on Brunot's Island in the Ohio River, about a mile down the river from the business district of Pittsburgh, and the station at Rankin, on the Monongahela River, about two miles up the river from the business district. The major factors considered at these locations comprised the price of the necessary additional land required for each station to provide an increase in capacity to take care of the future load in the district when operated in conjunction with the then existing station and existing capacity at the other location; the volume and quality of condensing water available; quality of the water for boiler feed; prices of coal both present and estimated for future years, and means and cost of ash disposal.

At Brunot's Island and at Rankin there were sufficient areas for large stations, and at both of these sites there was ample condensing water available for stations of any required size, but the quality was bad for both the use of surface condensers and for boiler feed, that at Rankin being the worse. At both sites there were


Total Power Costs by Years for Existing Generating Stations and Proposed Substations to replace them, Including all Fixed and Operating Charges for Peak Load Service in Dollars
170,000
160,000
150,000
140,000
130,000
120,000
110,000
100,000
0
A
A=Existing generating stations that should be continued in service
B=Existing stations that should be replaced by substations
Costs of power from existing generating station with station operated at same peaks and load factors as proposed substation, indicated by
Costs of substation power with substation operated at same peaks and load factors as existing generating station, indicated by
B
1914
1915
1916
1917
1918

GRAPHICAL ANALYSES HELPED SOLVE THE PROBLEM

ample transportation facilities for the delivery of coal to the stations by both water and rail.

Estimates of production costs indicated that for the two smaller sizes of station considered—40,000 kw. and 75,000 kw.—Brunot's Island would produce power at the lower cost, while for the largest size, or 140,000 kw., the production costs were the same at both sites. Although the cost of delivered power from Rankin was somewhat lower, the water was of better quality at Brunot's Island, in view of which, together with the large probable increase in power demand down the Ohio River and northwest of Pittsburgh, it was decided that Brunot's Island should be selected as the only existing station where additional equipment should be installed.

Steam Stations Using Coal for Fuel at New Sites Selected as Feasible.—Under the foregoing analyses, the disposition of existing generating stations and the selection of those which could be increased in capacity to produce power at the lowest cost having been determined, the next step was to ascertain feasible sites for new stations of all the types selected as possible, the

first type to be considered being steam stations using coal for fuel.

In this study it became evident from the starting of the investigations that if the profit accruing to the coal companies from the mining of coal could be eliminated from the fuel costs to the power company a saving would result in the net cost of power production. In view of this it was determined that any new steam station using coal for fuel should be located in the coal-mining district and on the rivers where sufficient water was available for condensing purposes, and further that the power company should purchase and operate coal property of sufficient acreage to take care of future requirements of the system for at least a fifty-year period. The rivers having sufficient water for condensing purposes to meet the requirements of large generating stations were the Ohio, the Monongahela and the Allegheny. No coal properties were available on the Ohio, while many were available on the two other rivers. From the survey made of the coal fields on these two rivers it was found that to secure sufficient acreage of good coal at a reasonable price and not too far back from the river frontage it was necessary to go up the Monongahela as far as Riverview, about 16 miles from Pittsburgh by air line, and up the Allegheny about 12 miles to Harmarville. It was further found that Morgantown, West Va., on the Monongahela, was the farthest point upstream on this river from Pittsburgh where there was sufficient condensing water at 50 per cent load factor for the smallest size of generating station considered, which was 40,000 kw. At this point ample acreage of good-quality coal was available at a comparatively low price, while on the Allegheny River it was found that the thinness and distance underground of the coal veins and the quality of the coal would not permit mining in sufficient quantity and at a low enough cost to warrant the location of a station farther upstream than at a point in the vicinity of Harmarville. Therefore the sites selected as feasible outside of Pittsburgh for the location of steam stations using coal for fuel narrowed down by a process of elimination to Riverview and Morgantown on the Monongahela River and to Harmarville or vicinity on the Allegheny. Estimates were then prepared for the various sizes of stations selected for comparison, giving the cost of power delivered in Pittsburgh from the selected sites, including fixed charges on the investment required for generating stations, coal lands, mines, transmission and substations, together with the operation and maintenance charges on all of these items. Thus the estimated net costs of power delivered in Pittsburgh from each site were ascertained.

SITE INFLUENCED BY CIRCULATING WATER

From these estimates it was evident that for a new station outside of Pittsburgh using coal for fuel Harmarville would give the lowest cost of power delivered in Pittsburgh, and therefore that site was selected as the best for this type of station. An especially important factor in selecting the Harmarville site, and one which has not been previously mentioned, was the fact that the quality of condensing water was better than at the other locations, the site being on the west side of the river, where the water was not greatly affected by acid from coal mines on the Kiskiminetas and Conemaugh Rivers. While the coal was not of such good quality as that on the Monongahela River, the acreage available was ample, the cost moderate and the minable veins were at a sufficiently shallow depth and of sufficient thickness to make the fuel cost to the power company somewhat lower than at the other locations.

BYPRODUCT STATIONS CONSIDERED

Other Studies of Steam Stations and Internal-Combustion-Engine Stations at New Sites Selected as Feasible.—Space in this paper will not permit of setting forth in detail all of the studies made of the costs of production and delivery of power for all types of steam and explosion-engine stations from sites outside of Pittsburgh considered as feasible. A brief outline of the studies made and the net results are given in order to explain the conclusions reached with sufficient clearness for the purposes of this paper. These studies included the following:

1. Steam stations using byproduct coke-oven gas for fuel, including fixed and operating charges on coal acreage and mines and byproduct coke ovens, together with the revenue to be derived from the sale of the coke-oven byproducts.

The sites included Morgantown, West Va., where it was proposed to purchase the necessary coal acreage and to own and operate both mines and coke ovens. Estimates of the cost of producing power and of delivering it to Pittsburgh with all the generation at the Morgantown site were made, together with estimates of generating and transmitting the same quantity of power from Morgantown combined with the shipment of the power company's coal by river and rail to Brunot's Island and the generation and delivery of the power required from Brunot's Island with Morgantown coal. It was found that under these conditions, while the costs of power were very low, the actual investment required was enormous and the problem of financing uncertain. Moreover, the necessity of the power company's going into the byproduct coke-oven business was held to be an undesirable complication. Taking all these factors into consideration, it was evident that a mine owned and operated by the power company and combined with a byproduct coke-oven-gas generating station at Morgantown was impracticable.

2. The same analyses as above were made for mines supposedly owned and operated by the power company at Morgantown, and for the shipment of coking coal to a byproduct coke-oven gas-fuel generating station supposedly owned and operated by the power company at Rankin, together with the shipment of the power company's coal from Morgantown to Brunot's Island. It was found under these conditions that the cost of delivered power was higher than under the first plan with the generating station at Morgantown, and owing to this and the enormous investment and the difficulty of financing the plan it was eliminated.

3. Byproduct coke-oven internal-combustion-engine stations, including fixed and operating charges on coal acreage and mines and byproduct coke ovens, together with the shipment of power-company coal from Morgantown to Rankin and Brunot's Island, gave extremely low power costs, but the same undesirable features as to excessive investment, difficulty of financing, etc., were inherent in the plan, and it was therefore abandoned as impracticable.

4. Studies as to the cost of producing and delivering in Pittsburgh power from natural-gas internal-combustion-engine stations in the West Virginia gas fields, with gas purchased in the fields and without investment in

gas wells or delivery lines to the generating stations, resulted in arriving at a comparatively high net cost of power delivered, and this method was therefore eliminated from further consideration.

5. Additional studies were made as to the cost of producing and delivering power from internal-combustion-engine stations in Pittsburgh, with byproduct coke-oven gas purchased in Connellsville district and pumped to Pittsburgh in duplicate power-company pipe lines, and with natural gas purchased in the West Virginia gas fields and pumped to Pittsburgh through duplicate power-company pipe lines also, the compressing stations in both instances being owned by the power company and the gas compressed for transmission to 350 lb. in each case, two compressions being estimated as required for coke-oven gas and one for natural gas. The results of the analyses indicated a net cost of power delivered in Pittsburgh too high for further consideration, and in view of this, together with the experimental nature of the project, high investment, difficulty of financing, etc., the plan was eliminated.

While it was believed from the start, owing to all the uncertain factors involved in the production of power from coke-oven gas and from natural gas, that any plan using gas as a source of power would be eliminated in the final analysis, it was considered that a survey of the problem of the generation and distribution of power in the Pittsburgh district would not be complete unless such analyses were made.

Hydro-Electric Power from Developments Selected as Feasible.—So far, the studies made having disposed of the questions of continuing in operation certain existing generating stations, of discontinuing the operation of certain other existing generating stations and on what dates, of the selection of one existing generating station for the installation of additional equipment, and of the determination of a site for a new station to be of the steam-coal-fuel type, including ownership and operation of mines, there still remained one question to settle and that which it was expected from the beginning would be the all-important one. This question was whether or not hydro-electric power could be developed and delivered in Pittsburgh at a sufficiently low cost to warrant the necessary investment. The investigation made of this subject was especially comprehensive and thorough, involving careful studies of all United States Geological Survey and state survey data on topography, rainfall and stream flow for the sections surveyed to date, together with field inspections of all the hydro-electric developments indicated by these surveys as possible and field inspections and surveys of sections of territory not covered by either the federal government or state surveys and including the territory within a radius of about 150 miles from Pittsburgh as a center. After several months of this investigation conducted in the office and in the field the possible projects narrowed down to a total of ten developments, which by a further process of elimination were reduced to two developments considered as entirely feasible from all viewpoints. For the purposes of this paper these are designated as Sites No. 1 and No. 2.

From a consideration of power alone, both as to quantity and as to cost, the development at Site No. 1 was the best, but the investment was large and the distance of transmission excessive as compared with a smaller investment for the development at Site No. 2 and a much shorter transmission. Owing to the above considerations and the fact that the financing of the No. 2 site could be more readily effected, the latter was selected as the most feasible.

With the No. 2 site selected, further comparisons were made to determine whether it would be more economical to generate power from steam stations alone or to combine hydro-electric power from the No. 2 site with steam generation at Brunot's Island, Rankin and Harmarville. Estimates covering this involved much detail, but the results indicated that all steam generation for the immediate future would be slightly more economical than part hydro-electric and part steam. This is not readily apparent in view of the fact that the cost of hydro-electric power at 50 per cent load factor delivered in Pittsburgh from the No. 2 site was less than the cost of power from steam stations using coal as fuel and operated at the same load factor. The apparent contradiction is brought about, however, by the reduction in load factor and the increase in kilowatt-hour costs made necessary for the steam stations in order to utilize the hydro-electric power, and the consequent increase in the net cost of power per kilowatt-hour from the hydro-electric and steam combination as compared with all-steam generation.

FINAL RESULT OF STUDY

While it was considered that the advantage of water power would become more apparent in the future, owing to the inevitable increase in the cost of coal, it was apparent also that improvements in the art of steam-station design and operation due primarily to the increase in the sizes and higher efficiencies of steam turbines and boiler units might readily offset the increase in fuel costs.

In view of all these uncertainties, with the enormous investment required for hydro-electric stations of comparatively small size, as well as the equally large investments required for steam stations using gas for fuel, it was evident that for the immediate and future requirements in the western part of the district both down the Ohio River and up the Monongahela the more conservative policy would be to increase the capacity of the coal-fuel steam station at Brunot's Island; that to provide for the immediate and future requirements of the eastern part of the district, together with the very large additional industrial power demand throughout the district as a whole, the construction of a coal-fuel steam station should be started in the near future at or near Harmarville on the Allegheny River, and that all of the stations should be interconnected by adequate high-tension bus lines to permit of the most economical operation of the entire system.

The Harmarville site was later abandoned largely because of the cost of necessary dredging required for deepening the channel for condensing water, and the location of the present large station at Colfax, or Cheswick as it was known in the original investigations, and the acquisition of the coal-mining property appertaining to it were finally determined upon, in accordance with recommendations made jointly by Ford, Bacon & Davis and the chief engineer of the Duquesne Light Company. The present Colfax station is, however, within a few miles of the originally selected Harmarville site on the Allegheny River, and the assumption is warranted that the analyses made and the conclusions reached in both the original and the final investigations were, generally speaking, correct as to the solution of the broad problem of power production and distribution for the Pittsburgh district.

Comparing Direct and Indirect Lighting*

Experiments Put the Average Intensities for Ordinary Reading at 2.8 Foot-Candles for Direct Lighting and 4 Foot-Candles for Indirect

BY WILLIAM KUNERTH
Associate Professor of Physics, Iowa State College

THE contradictions in existing data have opened anew the question of the relative intensities required under direct and under indirect lighting systems, and it was the hope of the writer to ascertain why a person needs more natural light than artificial light for a certain kind of work. Accordingly it was planned to make an experiment on a great number of individuals and under conditions such that the illumination would be decidedly diffused in one case and exclusively direct in the other case. The room used for this experiment was 30 ft. long, 18½ ft. wide and 13 ft. high. The ceiling and the upper half of the walls were painted white; the lower half of the walls and the floor were drab.

For the direct lighting the lamps were hung 7 ft. above the floor, and opaque white-enameled reflectors were used. As this work was done at night (actually between 7 p.m. and 8 p.m.), the window shades were raised so that no light was reflected from them but so that the light passed out through the windows. Every precaution possible was taken to have all the light on the book come directly from the fixtures.

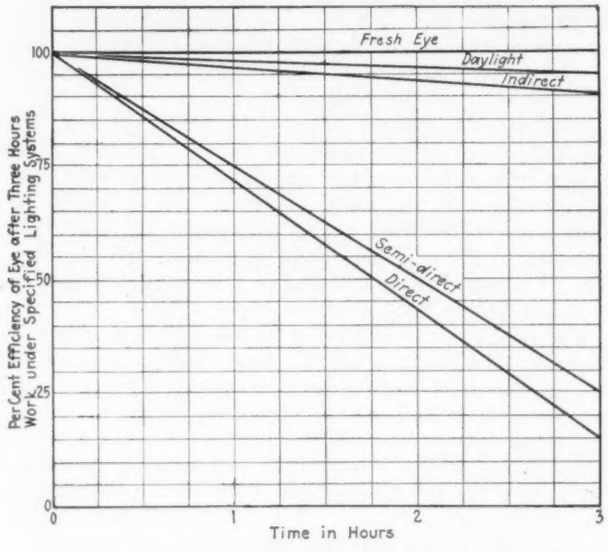
For the indirect system silvered reflectors of the opaque-bowl type were used, and thus no light passed directly from the light sources to the printed page. They were hung about 2 ft. below the ceiling. In this case the yellow window shades were pulled down so as to augment the reflected light. Gas-filled lamps were used in both cases. The value of the current which it was necessary to put through the lamps in order to get the illumination approximately the same in the two cases was ascertained by a preliminary test. At the same time, the current was so adjusted as to produce a variation in lighting intensity from one which was too low for comfortable reading to one which was too high.

After the twenty-six individuals had been under any one condition of illumination for upward of five minutes they were asked to put down their opinion of the lighting on the basis of the instructions given them. Then the current through the lamps was changed and observations again made. In this way five different values of current were used, changes in intensity being made by irregular stages and not always in the same direction, and the individuals did not know but that any value of current might be duplicated. Then the other system was installed and the five conditions repeated, except that the current values differed from the first set because of the difference in the efficiency of installation already noted. During the few minutes while the change was being effected from one system to the other the students were free to move about in the room. The arm of the chair on which the book was placed was 28 in. above the floor and sloped at an angle of 2½ deg. from the horizontal.

After the individuals had recorded their estimates of the illumination on their books under these conditions, the same conditions were repeated and the intensity in foot-candles which each individual had had on his book was measured by means of a Macbeth illuminometer. The number of foot-candles which each one considered as "just right" by the two systems is given in the table herewith. It will be seen that a few estimates are very high, while a few others are very low.

Even though some of the students required much less illumination intensity than is ordinarily considered satisfactory, it may be noted that they required less of both indirect and direct lighting and hence the ratio between the two, the determination of which was the chief object of this experiment, is left practically unaltered.

When we drop out the abnormal intensities we get an average of 2.77 foot-candles for the direct and



COMPARISON OF DIFFERENT FORMS OF ILLUMINATION

4.13 foot-candles for the indirect. It may be seen, therefore, that by the indirect system we need an intensity almost 50 per cent greater than that required by the direct system for the same kind of work.

Since under the indirect lighting system everything in the field of vision is about equally illuminated, the pupil contracts much more than it does under the direct system, where much of the field is dark. In the latter case the pupil will enlarge to allow more light to enter and will soon come to a state where a person can read print comfortably even though the actual intensity is small. It seems then that the illumination intensity required depends quite largely upon the brightness of the objects in the field of vision. If they are as bright as the objects on which we wish to focus our attention, then a high intensity is required; if, on the other hand, they are dark, the pupil will enlarge to take in a big flood of light and a smaller intensity will suffice.

The question which was at the bottom of this undertaking and which really prompted it was why a greater intensity of natural light is required for the same kind of work than is required of artificial light. Since natural lighting is only an extreme case of indirect lighting, it will be evident that our question is answered by the above data. It seems reasonable that this should be the case, for with indirect or natural lighting the objects in the range of vision are illuminated and the light reflected into the eye causes a contraction of the

*Abstract of a paper presented before the Iowa Academy of Science.

INTENSITIES IN FOOT-CANDLES REQUIRED FOR READING ORDINARY TEXTBOOK PRINT BY TWO SYSTEMS OF LIGHTING

	Direct	Indirect		Direct	Indirect
1	2.0	2.5	14	3.0	3.5
2	7.0	5.7	15	3.0	3.0
3	3.0	2.0	16	2.3	5.0
4	2.3	2.3	17	3.0	6.5
5	1.1	1.9	18	4.0	6.7
6	1.8	4.9	19	3.0	3.0
7	2.0	6.0	20	3.0	3.0
8	5.0	6.5	21	1.0	3.7
9	5.0	3.0	22	1.5	6.0
10	3.0	5.0	23	2.0	6.0
11	2.5	4.3	24	2.3	2.3
12	3.0	2.3	25	2.3	2.5
13	3.0	4.5	26	1.7	3.0
Average				2.8	4.0

pupil, and hence a greater intensity is required for clear vision. For the direct artificial lighting most of the light which enters the eye comes from the printed page, and hence the pupil is larger and clear vision is obtained with a lower intensity.

In the direct lighting system the path of the beam of light from the source to the book is short—much shorter than for the indirect system. It follows, therefore, that the flux of light on the floor near the individual for the direct system is much less than on his book, but such is not the case for the indirect system where the path of the beam of light from the source to the book is almost the same as from the source to the floor. Thus if we had 3 foot-candles on the book by each system and 2 foot-candles on the floor by the direct system, we should probably have 2.8 foot-candles on surrounding objects by the indirect system. This would cause pupillary contraction, and hence a greater intensity would be required for clear vision.

Color Does Not Affect Results

It may be argued that in this experiment the change of current through the lamps caused a change in color which served to affect the results, but whenever the color was abnormal, owing to the small current, the intensity was too low for comfortable reading and hence did not affect the conclusion here arrived at.

Again, it may be urged that five minutes was too short a time in which to form a final opinion on a lighting system, but inasmuch as the persons concerned had been studying illumination for three months, and since an equal period was allowed for each condition or illumination, it is felt that the conclusions here arrived at can be considered reliable.

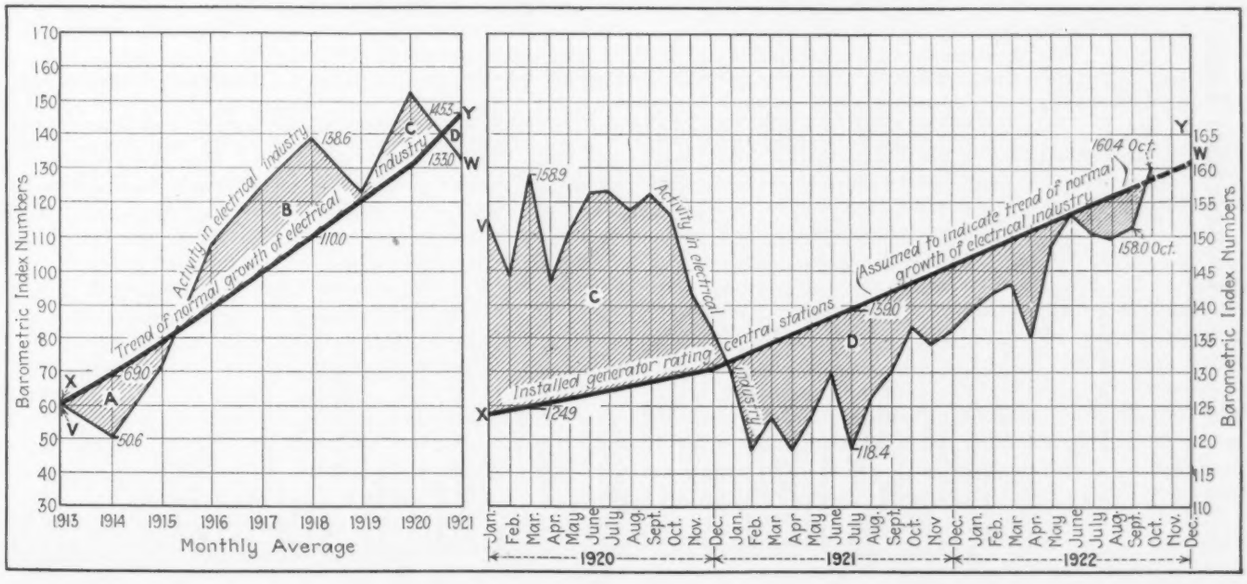
Industrial Activity Back to 1920 Levels

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that October activity within the industry was in excess of even the peak month of 1920. The end of the tie-up in the bituminous-coal industry enabled the primary industries of the country to expand operations to meet the accumulation of unfilled orders and the natural growth of demands for commodities. Iron and steel mills, textile mills, coal mining, copper production, automobile production and cement and brick production all reported largely increased operations over September.

The "Electrical World Barometer" indicates that during the month of October business conditions in the electrical industry, taken as a whole, were, for the first time since December, 1920, above what would have been the point of seasonal demand if growth in the industry had been normal. The basic data indicate an increase of 9.0 points in the barometer scale as compared with September. The electrical industry as a whole was operating at 2.4 points above what would have been the point of seasonal demand if growth in the industry had been normal. In September it was operating at 5.9 points below the point of normal demand.

It would appear that the electrical industry is headed for a long season of unusual activity and that the area "D" of the "Electrical World Barometer" has at last been closed. Central-station operations for October were approximately 6 per cent above those of September and about 25 per cent above those of October last year. October witnessed only the beginning of the increased winter activities of the electric light and power division of the industry, and the returns in that month point unmistakably to a season of record-breaking operations in every branch of electrical business.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS

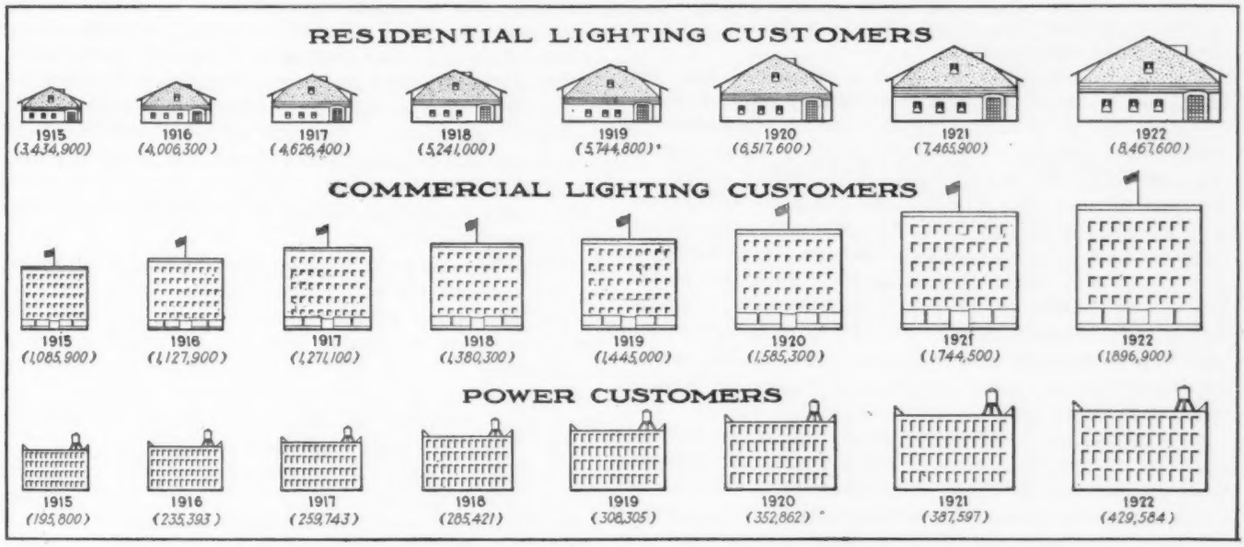


Commercial Lighting Customers Served by Electric Light and Power Companies

State and Sections	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number (Thousands)	New Customers During 1915 (Thousands)	Per Cent Gain During 1915	Total Number (Thousands)	New Customers During 1916 (Thousands)	Per Cent Gain During 1916	Total Number (Thousands)	New Customers During 1917 (Thousands)	Per Cent Gain During 1917	Total Number (Thousands)	New Customers During 1918 (Thousands)	Per Cent Gain During 1918	Total Number (Thousands)	New Customers During 1919 (Thousands)	Per Cent Gain During 1919	Total Number (Thousands)	New Customers During 1920 (Thousands)	Per Cent Gain During 1920	Total Number (Thousands)	New Customers During 1921 (Thousands)	Per Cent Gain During 1921
United States	1,127.9	110.8	10.8	1,271.1	143.2	12.7	1,380.3	109.2	8.4	1,445.0	64.7	4.8	1,585.3	140.3	9.7	1,744.5	159.2	10.1	1,896.9	152.4	8.7
SECTIONS																					
New England	95.1	8.9	10.2	102.4	7.3	7.7	110.9	8.5	8.3	115.2	4.3	4.0	126.5	11.3	9.7	144.8	18.3	14.5	158.2	13.4	9.2
Middle Atlantic	270.0	32.3	13.6	303.8	33.8	12.3	328.2	24.4	8.2	343.7	15.5	4.6	386.1	42.4	13.2	425.5	39.4	10.3	460.7	35.2	8.2
South Atlantic	76.1	5.0	7.1	82.7	6.6	8.6	88.7	6.0	7.2	94.5	5.8	6.4	105.4	10.9	11.5	120.1	14.7	14.0	132.9	12.8	10.6
East North Central	273.5	14.7	5.6	323.4	49.9	18.2	350.2	26.8	8.3	362.1	11.9	3.4	399.9	37.8	10.3	425.6	25.7	6.4	464.1	38.5	8.9
West North Central	148.2	22.1	17.5	169.7	21.5	14.4	187.6	17.9	10.6	196.1	8.5	4.5	209.1	13.0	6.6	229.9	20.8	10.0	243.3	13.4	5.8
East South Central	41.8	3.5	9.2	44.4	2.6	6.2	47.1	2.7	6.0	49.4	2.3	5.0	50.6	1.2	2.5	55.3	4.7	9.4	58.8	3.5	6.3
West South Central	39.4	4.0	11.4	46.5	7.1	18.0	54.6	8.1	17.4	60.1	5.5	10.0	67.3	7.2	12.0	75.3	8.0	11.8	81.6	6.3	8.4
Mountain	41.3	2.9	7.7	46.5	5.2	12.4	50.8	4.3	9.4	51.2	0.4	0.7	52.7	1.5	2.9	54.9	2.2	4.2	55.7	0.8	1.3
Pacific	142.5	17.4	11.4	151.7	9.2	6.4	162.2	10.5	7.0	172.7	10.5	6.4	187.7	15.0	8.6	213.1	25.4	13.5	241.6	28.5	13.3
NEW ENGLAND:																					
Maine	15.2	1.4	10.2	16.1	0.9	5.9	17.7	1.6	10.0	18.3	0.6	3.4	20.3	2.0	10.9	23.3	3.0	14.8	24.8	1.5	6.4
New Hampshire	1.6	0.2	14.2	1.8	0.2	12.4	1.9	0.1	5.5	2.1	0.2	10.5	2.5	0.4	19.1	3.0	0.5	20.0	3.1	0.1	3.2
Vermont	7.5	1.1	17.1	7.8	0.3	3.9	8.1	0.3	3.8	8.3	0.2	2.5	9.2	0.9	10.8	10.6	1.4	15.2	11.5	0.9	8.4
Massachusetts	39.4	2.1	5.5	42.8	3.4	8.6	46.4	3.6	8.2	48.0	1.6	3.4	52.0	4.0	8.3	61.4	9.4	18.1	67.5	6.1	10.0
Rhode Island	14.4	2.8	24.2	15.6	1.2	8.3	16.9	1.3	8.3	17.5	0.6	3.5	19.0	1.5	8.5	21.9	2.9	15.2	25.1	3.2	14.6
Connecticut	17.0	1.3	8.2	18.3	1.3	7.6	19.9	1.6	8.8	21.0	1.1	5.5	23.5	2.5	11.8	24.6	1.1	4.6	26.2	1.6	6.5
MIDDLE ATLANTIC:																					
New York	144.3	18.3	14.5	162.2	17.9	12.3	173.5	11.3	7.0	183.4	9.9	5.7	209.5	26.1	14.2	232.5	23.0	11.0	252.0	19.5	8.4
New Jersey	35.9	4.2	13.2	41.1	5.2	14.3	46.5	5.4	13.2	48.8	2.3	5.0	55.3	6.5	13.3	61.0	5.7	10.3	66.0	5.0	8.2
Pennsylvania	89.8	9.8	12.4	100.5	10.7	12.0	108.2	7.7	7.5	111.5	3.3	3.1	121.3	9.8	8.8	132.0	10.7	8.8	142.7	10.7	8.2
SOUTH ATLANTIC:																					
Delaware	1.3	0.2	18.2	1.4	0.1	7.6	2.3	0.9	64.2	2.4	0.1	4.3	2.7	0.3	12.4	3.1	0.4	14.8	3.4	0.3	9.6
Maryland	10.4	1.1	11.8	11.9	1.5	14.3	14.0	2.1	17.6	14.3	0.3	2.1	15.6	1.3	9.1	16.2	0.6	3.8	18.5	2.3	14.2
District of Columbia	7.0	0.7	11.1	7.9	0.9	12.8	8.3	0.4	5.0	9.7	1.4	16.8	10.5	0.8	8.1	11.1	0.6	5.7	12.5	1.4	12.5
Virginia	9.9	0.3	3.0	10.7	0.8	8.1	11.2	0.5	4.6	11.2	0.0	0.0	12.2	1.0	8.9	12.8	0.6	4.9	13.0	0.2	1.5
West Virginia	3.4	0.5	17.2	4.0	0.6	17.6	4.2	0.2	5.0	5.1	0.9	21.4	5.8	0.7	13.6	7.8	2.0	34.5	9.2	1.4	17.9
North Carolina	11.8	0.7	6.3	12.7	0.9	7.6	13.2	0.5	3.9	14.8	1.6	12.2	16.7	1.9	12.8	19.0	2.3	13.8	20.8	1.8	9.3
South Carolina	6.5	0.2	3.2	7.0	0.5	7.6	7.1	0.1	1.3	8.1	1.0	14.0	9.3	1.2	14.7	10.6	1.3	13.9	13.1	2.5	23.6
Georgia	16.2	1.3	8.6	17.5	1.3	8.0	17.8	0.3	1.7	17.5	—0.3	—1.7	21.0	3.5	20.0	27.0	6.0	28.6	28.4	1.4	5.2
Florida	9.6	0.0	0.0	9.6	0.0	0.0	10.6	1.0	10.3	11.4	0.8	7.6	11.6	0.2	1.7	12.5	0.9	7.8	14.0	1.5	12.0
EAST NORTH CENTRAL:																					
Ohio	61.4	6.0	10.7	68.2	6.8	11.1	75.2	7.0	10.3	76.4	1.2	1.5	86.9	10.5	13.8	91.4	4.5	5.2	96.6	5.2	5.6
Indiana	20.7	1.5	7.8	22.6	1.9	9.1	26.6	4.0	17.7	27.4	0.8	3.0	31.5	4.1	14.9	37.7	6.2	19.6	42.0	4.3	11.3
Illinois	97.0	4.7	5.0	120.3	23.3	24.0	126.8	6.5	5.4	133.5	6.7	5.2	147.5	14.0	10.4	153.8	6.3	4.3	170.3	16.5	10.8
Michigan	66.7	0.7	1.0	82.2	15.5	23.2	90.4	8.2	10.0	91.5	1.1	1.2	96.0	4.5	4.8	102.2	6.2	6.5	111.2	9.0	8.8
Wisconsin	27.7	1.8	6.9	30.1	2.4	8.6	31.2	1.1	3.6	33.3	2.1	6.7	38.0	4.7	14.1	40.5	2.5	6.6	44.0	3.5	8.6
WEST NORTH CENTRAL:																					
Minnesota	35.9	11.4	46.5	43.2	7.3	20.3	45.2	2.0	4.6	45.9	0.7	1.6	48.8	2.9	6.3	53.2	4.4	8.8	56.1	2.9	5.4
Iowa	21.3	0.7	3.4	21.7	0.4	1.8	22.2	0.5	2.3	22.7	0.5	2.3	22.8	0.1	0.4	25.1	2.3	10.0	27.6	2.5	10.0
Missouri	37.6	4.6	14.0	44.0	6.4	17.0	53.0	9.0	20.5	58.2	5.2	9.7	63.5	5.3	9.1	70.2	6.7	10.5	74.4	4.2	6.1
North Dakota	8.1	1.6	24.5	9.4	1.3	16.0	11.0	1.6	17.0	11.1	0.1	0.9	11.5	0.4	3.6	12.6	1.1	8.7	13.3	0.7	5.5
South Dakota	8.3	0.0	0.0	8.9	0.6	7.2	9.6	0.7	7.8	9.7	0.1	1.0	10.7	1.0	10.3	11.8	1.1	10.3	12.5	0.7	6.0
Nebraska	23.8	2.4	11.2	24.8	1.0	4.1	25.9	1.1	4.5	25.9	0.0	0.0	27.5	1.6	6.3	30.0	2.5	9.1	31.0	1.0	3.3
Kansas	13.2	1.4	11.8	17.7	4.5	34.2	20.7	3.0	17.0	22.6	1.9	9.2	24.3	1.7	7.5	27.0	2.7	11.1	28.4	1.4	5.2
EAST SOUTH CENTRAL:																					
Kentucky	17.1	1.3	8.2	17.9	0.8	4.7	19.2	1.3	7.3	19.6	0.4	2.1	20.7	1.1	5.6	22.3	1.6	7.8	24.2	1.9	8.5
Tennessee	10.7	1.9	21.5	11.5	0.8	7.4	11.8	0.3	2.5	12.5	0.7	5.8	11.6	—0.9	—7.2	12.9	1.3	11.2	13.5	0.6	4.6
Alabama	5.3	0.3	6.0	6.3	1.0	18.8	6.6	0.3	4.8	7.1	0.5	7.5	7.9	0.8	11.2	8.6	0.7	8.8	9.1	0.5	5.8
Mississippi	8.7	0.0	0.0	8.7	0.0	0.0	9.5	0.8	9.2	10.2	0.7	7.3	10.4	0.2	2.0	11.5	1.1	10.5	12.0	0.5	4.2
WEST SOUTH CENTRAL:																					
Arkansas	6.9	0.9	15.0	8.1	1.2	17.4	9.1	1.0	12.2	9.9	0.8	8.7	11.2	1.3	13.1	12.4	1.2	10.6	12.8	0.4	3.2
Louisiana	5.7	0.7	14.0	6.7	1.0	17.5	7.5	0.8	11.9	8.2	0.7	9.3	9.3	1.1	13.3	11.8	2.5	26.7	12.6	0.8	6.8
Oklahoma	7.6	0.5	7.0	8.3	0.7	9.2	9.1	0.8	9.6	9.9	0.8	8.7	11.2	1.3	13.1	12.1	0.9	8.0	13.6	1.5	12.4
Texas	19.2	1.9	11.0	23.4	4.2	21.8	28.9	5.5	23.5	32.1	3.2	11.1	35.6	3.5	10.8	39.0	3.4	9.5	42.6	3.6	9.2
MOUNTAIN:																					
Montana	6.1	0.8	15.1	6.5	0.5	8.2	7.8	1.2	18.0	8.8	1.0	12.8	8.5	—0.3	—3.4	8.7	0.2	2.3	8.6	—0.1	—1.1
Idaho	10.1	1.0	10.9	10.6	0.5	4.9	11.0	0.4	3.8	11.1	0.1	0.8	11.8	0.7	6.3	12.3	0.5	4.2	12.1	—0.2	—1.6
Wyoming	3.6	0.4	12.5	3.7	0.1	2.6	3.9	0.2	5.4	3.9	0.0	0.0	4.2	0.3	7.7	4.4	0.2	4.8	4.9	0.5	11.3
Colorado	11.3	0.0	0.0	12.5	1.2	10.5	13.6	1.1	8.7	13.5	—0.1	—0.7	13.6	0.1	0.7	14.2	0.6	4.4	14.6	0.4	2.8
New Mexico	1.7	0.0	0.0	1.8	0.1	5.9	2.0	0.2	11.1	1.7	—0.3	—15.0	2.1	0.4	23.5	2.2	0.1	4.7	2.3	0.1	4.5
Arizona	1.2	0.2	20.0	1.5	0.3	25.0	1.6	0.1	6.7	1.7	0.1	—0.6	1.9	0.2	11.7	2.0	0.1	5.2	2.0	0.0	0.0
Utah	5.4	0.6	12.5	8.0	2.6	48.0	9.1	1.1	13.6	9.1	0.0	0.0	9.1	0.0	0.0	9.5	0.4	4.4	9.5	0.0	0.0
Nevada	1.9	—0.1	—0.5	1.8	—0.1	—5.3	1.8	0.0	0.0	1.4	—0.4	—22.2	1.5	0.1	7.1	1.6	0.1	6.6	1.7	0.1	1.4
PACIFIC:																					
Washington	35.1	5.5	18.5	34.4	—0.7	—2.0	35.7	1.3	3.7	38.2	2.5	7.0	38.9	0.7	1.9	40.9	2.0	5.2	40.3	—0.6	—1.5
Oregon	12.0	1.1	10.2	13.1	1.1	0.9	13.7	0.6	4.5	13.1	—0.6	—4.4	14.2	1.1	8.3	14.9	0.7	4.9	16.0	1.1	7.3
California	95.4	10.8	12.8	104.2	8.8	9.2	112.8	8.6	8.2	121.4	8.6	7.7	134.6	13.2	10.7	157.3	22.7	17.0	185.3	28.0	17.8

Central-Station Customers Total 10,800,000

More Than 78 per Cent of This Number Are Domestic Lighting Customers — The Commercial Lighting Customers Total 1,896,900—Six Million Patrons Added in Seven Years



THE GROWTH IN CENTRAL-STATION CUSTOMERS HAS BEEN WITHOUT A BREAK

IF THE success and prosperity of any undertaking can be measured by the extent to which its product is consumed by the field it is striving to serve, then the electric light and power industry must be classed as successful and prosperous. The fact that this growth has continued through a period of record financial and business depression, during which practically all other primary industries were forced to make extensive curtailments in operations, is an added proof of the extent to which the electric light and power industry has intertwined itself with the framework of America's industrial, domestic and commercial being.

More than six million new customers of all classes have been added to the service lines of the central generating and distributing companies during the past seven years, according to a country-wide survey, recently completed by the *Electrical World*. On Jan. 1, 1922, there were 10,794,084 central-station customers. Of these 8,467,600, or 78.4 per cent, were domestic lighting customers; 429,584, or 4.0 per cent, were industrial power customers, and 1,896,900, or 17.6 per cent, were commercial lighting customers. Details of the growth in number of domestic lighting customers will be found in the *Electrical World* for Jan. 14, 1922, and the industrial power customers were covered in the issue of Sept. 23, 1922.

The accompanying tabulations and diagrams indicate the annual growth in the number of central-station commercial lighting customers. Under this classification are included stores, hotels, theaters, schools, hospitals, public buildings, etc. It appears from returns received from about 70 per cent of the electric light and power industry that during the period of extreme industrial and business inactivity last year 152,400 new customers of this class were added to the lines, which is only slightly less than the number added during 1920, the peak year in American business.

It is but natural that the sections of the country having the largest population should report the greatest number of commercial lighting customers. The East North Central and the Middle Atlantic States have almost the same number of customers of this class, 464,100 and 460,700 respectively. The West North Central States follow with 243,300, and the three Pacific States taken as a whole are fourth with 241,600 customers.

New York, with 252,000, easily leads the states of the Union in the number of commercial lighting customers. This is due primarily not only to the fact that the metropolis of the nation is in this state but also to the circumstance that 82.7 per cent of the people of New York State live in towns and cities of more than 2,500 population.

California reports the second largest number of commercial lighting customers, with 185,300. The reason, however, for this relatively large number of customers is quite different from that given for New York State. Almost one-third of the people of California live in rural districts, but the transmission and distribution systems of the central-station companies of that state cover virtually every rural section, and it is a very rare exception when rural hotels and stores are not electrically lighted. Moreover, California's commercial growth is recent and rapid as compared with that of the older states of the East, California's population having quadrupled during the last forty years.

Getting Closer to the People*

Utility Official Should Represent Company in Giving News to the Press and the Public— Use of Advertising

BY JOSEPH B. GROCE
Director New England Bureau of Public Service Information, Boston

GRADUALLY the public is going to know more about its public utilities than it ever did before. The destructive force of silence is no longer at work in the public utility industry. By the "public" we do not mean politicians. What kind of a man is a politician? Some one has said:

"If he is successful, if he is a man who can win elections, he is a man who takes public opinion as he finds it. He wastes little or no time in attempting to mold public opinion. He spends most of his time finding out what the public wants and trying to get it. At least he does this for his constituents. If he does not, he will be unable to get their votes. As public opinion changes he changes or he loses his power as a politician. His tenure of office depends upon the people. If the people are all against a public utility and he makes it as unpleasant as he can for that utility, he gets votes. On the other hand, if that utility turns around and educates the people and wins their favorable opinion, he must keep his hands off or lose votes."

The first point to bear in mind, therefore, is this question of public opinion. If a public utility allows false impressions to linger and grow until they seem to the public at large like actual facts, how can that public utility expect the public at large to feel favorable toward it? On the other hand, if the public utility is well managed, if it is giving efficient service, if it is a company the community may well be proud of, and the management takes steps to give the public the real facts, it stands to reason that a lot of trouble is going to be avoided.

J. F. Hull, president of the Missouri Press Association, in a recent address before the Missouri Association of Public Utilities stressed these three points:

1. Managers of public service companies should keep in close personal touch with their customers.

2. Employees of public service companies should not spare any pains to explain the methods of operation, cost, rates, etc., to customers. Explain the cause of any failure to render good service and point out ways in which the service may be made better.

3. Public utilities should fully explain facts of operation and seek to obtain and retain the good will and confidence of the people. The local press offers the best means of accomplishing this essential condition.

That last sentence is the second point to bear in mind—use of the local press in order to educate the public and for the purpose of establishing and fostering a good public opinion.

It seems to me that every well-managed public utility should have one man in its organization, and preferably one of its chief executives, with whom the local newspapers could consult at all times, freely and frankly, in regard to the public policy of the utility.

If a newspaper man is sent to a public utility office for a piece of news, he should not be turned over to anybody and everybody to get his information. He should always have an opportunity to get a plain statement of facts from a reliable source. The cub reporter is the future editor, and the editors of our newspapers are a large factor, even today, in shaping public opinion. There is in my judgment, therefore, no safer, saner way to establish and foster a good public opinion for a company—always dependent of course on the fact that it is giving good service at fair rates—than to have an *entente cordiale*, as the French say, with local newspapers.

One other factor must be added to this. There must be a courteous, obliging, considerate corps of officials—managers, superintendents and employees. Some one has said: "With these two factors, good service at fair rates and courteous officials, no utility is likely to experience any great amount of unfavorable public sentiment. Without these the case is absolutely hopeless."

Finally, there should be intelligent, persistent and consistent publicity on the part of every public utility.

In a general way, our *News Bulletin* is supplying each week to every newspaper in New England, both daily and weekly, something educational and, we feel, something worth reprinting.

But newspapers are particularly anxious at all times to get information and news with local color. Would it not be a good practice, therefore, to cultivate this field and make a regular business of supplying each week some piece of information, some local news, in regard to what is happening or going to happen in the company? Through the publication in the newspapers of this material public confidence is going to grow, for the public will soon realize that the utilities are being frank with them, that there is no mystery in the public utility industry, and the newspaper editor, if he has been unfavorable, will soon realize that frank statement of conditions, a willingness always to tell the facts, an appreciation of the real public ownership of the public utilities by the public, is not to be ignored.

Having prepared the way for better public relations through local executives and their department heads, there should be a series of advertisements prepared in harmony with the work of the men who have contact with the public.

A recent editorial in a large metropolitan daily reads as follows:

THE PUBLIC'S THE BOSS

Do you know that, under our laws, the people now practically run the public utilities?

That these utilities cannot expand through profits and must make additions with new money only?

That they cannot make more than a reasonable profit on their investment—the amount of the investment being determined by the people as per the showing of physical property—stocks and bonds not being taken into consideration?

That all this is so, not necessarily because any public utility company wants it so, but because the people's laws make it so?

The great public will not readily accept these statements as accurate, and such statements are most unpopular. But they mighty near represent the exact situation—the people are mighty near being the practical owners of the public utilities these days, under the people's laws.

I firmly believe this is a pretty true statement of fact. And if this is so, I hope what I have briefly stated in this paper may suggest some of the many methods of convincing the public, our unconscious owners, first of the absolute necessity for their property in the community where they live, and then that that property is being fairly, honestly managed for the best interests of all. If this attitude toward the public is persistently pursued by the public utility companies, most of the public relations problems will eventually be solved.

*Abstract of address presented before the New England division of the N. E. L. A. at its New London convention, Sept. 5-8, 1922.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Paying Rental for Wire Crossings Over Railroads

To the Editors of the Electrical World:

We note in the Nov. 11 issue of the *Electrical World* an editorial headed "Why Pay Rental for Wire Crossings Over Railroads?" in which you cite the decision handed down by the New York Supreme Court, Appellate Division, on July 6, 1920, in an action brought by the New York Central Railway Company against the Middleport Gas & Electric Light Company. This case was also taken to the United States Supreme Court and the application for a writ of certiorari was denied—a fact which lends additional interest to the legal finding which you quote.

F. S. TRACEY,
Manager.

Middleport Gas & Electric Light Company,
Middleport, N. Y.

The Fused Neutral

To the Editors of the Electrical World:

Several letters that have appeared in the *Electrical World* recently seem to me to mix two separate and distinct problems, viz., (1) the distortion of voltage in a three-wire, 110-120-volt building wiring scheme due to the blowing of a neutral fuse, and (2) the relative security of a system of inside wiring having both legs of all two-wire, 110-volt lines "fused," compared with one having only one fuse per leg. These problems should be dealt with separately.

At the outset it may be stated that any three-wire system of the above class that is operating today with fused neutrals—and wherever I use the term "neutral" in this letter I mean the middle wire of the three wherever it exists, and that wire only—should be considered a back number. Surely there is no diversity of opinion as to the desirability of the solid neutral or the lawfulness of it; but its adoption is most fortunately coupled with one primary condition in all codes of any standing, and that is that the neutrals must be grounded in a thoroughly efficient manner, not by haphazard, makeshift methods but by dependable grounds made at known locations.

The permission to ground neutrals was first given in the National Electrical Code of 1901. In the 1909 edition, by Rule 13A, this practice in regard to alternating-current systems was advised as being preferable to running without grounds, while the 1913 edition makes grounding compulsory in both alternating-current and direct-current systems. I further note that the code as far back as 1907 allows the omission of the neutral fuse, provided that the system is properly grounded. I would also draw attention to the National Safety Code, which covers both these points in an admirable and lucid manner and calls for grounding and omission of fuses in the neutrals when grounded.

I would therefore suggest that it is in order for those who are concerned about fused as against unfused neutrals to get busy and see that their neutrals are properly grounded and thus conform to well-established rules. They will then not only be able to enjoy the added security afforded by the solid neutral, but perhaps will avoid the burden of fighting legal claims, such, for instance, as the one that ended so disastrously for certain central-station interests in the Province of Quebec. Editorial reference to this case was made in your issue of May 15, 1920, coupled with a salutary warning which I am afraid has not been as yet sufficiently taken to heart by central-station interests. Perhaps a few more expensive lessons are required to drive the obvious truth home.

I may trespass on your space at a later date to bring forward some views on the question of the value of fusing both sides of a two-wire system, but beg to suggest that future discussion would be more helpful if it followed the two-wire line and avoided befogging the issue with a point as to which there should be no difference of opinion in informed minds.

F. A. CAMBRIDGE,
City Electrician.

Winnipeg, Manitoba, Canada.

Theories of Insulation Failure

To the Editors of the Electrical World:

The heat generated in a filament of insulation owing to dielectric loss lowers its resistivity and so increases the dielectric loss. This in turn leads to the further generation of heat, and if this heat cannot be dissipated as fast as it is created, the temperature will rise until the filament burns. This theory was advanced by K. W. Wagner as the cause of failure of solid dielectrics.

The same idea was contained in a recent A. I. E. E. paper by C. F. Hanson and the writer in which the same phenomenon was explained in terms of the ionic theory. Conductivity of insulation is explained as due to the average mobility of the ions it contains. In this paper dielectric failure was also explained as due to ion mobility, but in this case it is the maximum and not the average ion mobility that is concerned. Hence there is no obvious connection between dielectric strength and resistivity, although both depend on ion mobility.

The paper by Messrs. Hayden and Steinmetz in the *Electrical World* of Oct. 21 advances the same theory from another standpoint, namely, that of progressive failure spreading from an original hot spot. This idea was also advanced by G. B. Shanklin at the Niagara Falls convention of the A. I. E. E., but he ascribed the initiation of the hot spots to local surges occurring at ionized vapor pockets.

The authors claim that solid insulation has not a definite dielectric strength. This is not in agreement with the findings of Dr. Wagner, who, in his paper, found that the dielectric strength of a plate is proportional to its thickness provided that electrodes are used which insure a uniform distribution of current.

The curves of Fig. 4 in the Hayden-Steinmetz article were made on sheets of unimpregnated linen paper, and the authors derived some of their conclusions from these results on the assumption that unimpregnated linen paper is a solid dielectric. As a matter of fact, such material is principally air, and it would not be safe to assume that real solids would possess similar characteristics.

The subject is a broad one, and it is interesting to see how different experimenters are closing in on a "pyro-electric" theory which, in turn, ties in with the ionic theory.

The article by Messrs. Hayden and Steinmetz is timely and suggestive. It is to be hoped that they will elaborate it and present it for discussion to the A. I. E. E.

W. A. DEL MAR.
Chief Engineer.

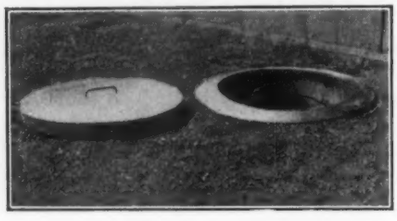
Habirshaw Electric Cable Company.
Yonkers, N. Y.

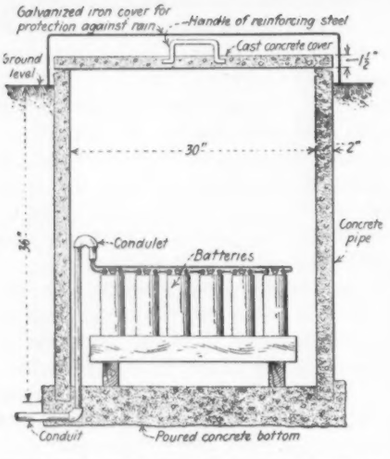
Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

Keeping Batteries Cool by Installing in Ground

AT SEVERAL of the substations of the Southern California Edison Company in the San Joaquin Valley where the summer tempera-





CONCRETE PIPE PROVIDES UNDERGROUND CHAMBER FOR STORAGE BATTERIES

ture is often very high the storage batteries used for oil-switch tripping and emergency lighting have been installed in the ground to keep them cool. Type B-4H Edison batteries of six and twelve cells are required for this service. The substation buildings are completely sided with glass, and although this is an advantage from the standpoint of lighting and fireproof construction, the temperature in the buildings in the summer is often considerably higher than the outside air.

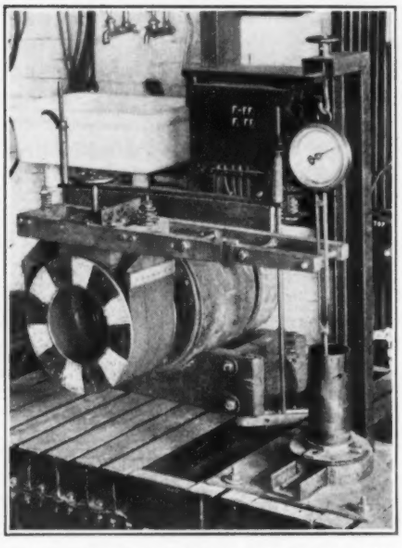
As a result of this condition the storage batteries are installed in sections of concrete pipe placed just below the surface of the ground as shown in the illustration, where the temperature is considerably lower than in the substation buildings. These sections of pipe are placed on end in the ground in holes dug for them. After the necessary conduit for the wiring has been installed, a concrete slab is poured in the bottom of the pipe for the batteries to rest on. A cover made of cast concrete is used. An additional galvanized cover is provided to prevent collection of water in rainy weather. The cost of each installation was approximately $50, 15 per cent of which was for labor. This method of installing small storage batteries has been in use for the past two years and has proved quite satisfactory.

E. R. STAUFFACHER,
Protection Engineer.
Southern California Edison Company,
Los Angeles, Calif.

Compact Brake for Motor Testing

FOR testing motors of various types and sizes up to 50 hp. and over with minimum loss of time and maximum convenience the laboratory of the Hartford (Conn.) Electric Light Company has built the brake set illustrated herewith. It consists of a friction drum, automobile brake lining, lever, spring balance and shock-absorber equipment mounted on steel I-beams and channels, the whole outfit occupying a floor space only 6 ft. long by 3 ft. wide. The motor horsepower is determined for the transmitting lever shown by multiplying the net force in pounds indicated on the dial of the spring gage by the speed of the motor in revolutions per minute and the product by the constant 0.000381. The effective length of the brake arm is 24 in.

Attachment of different motors to the base of the test set is facilitated by the use of 4-in. angles and channels with openings between their edges as shown, these being bolted to 6-in. longitudinal I-beams, which raise the lateral members sufficiently above the floor for convenient handling of motor pedestals, supporting blocks, bolts or clamps. The base rests upon the floor of the laboratory by gravity only, no bolting being needed. The scale is mounted on an adjustable hook carried by a right-angled column built of a 3-in. channel and terminating at the bottom in a circular base piece bolted to a steel plate in turn fastened to the base of the test equipment. An oil cylinder, 3¼ in. in diameter and 7½ in. high, immedi-



HOME-MADE TEST BRAKE HAS WIDE RANGE

ately under the end of the brake lever provides space for the upward and downward travel of a plunger disk, 3 in. in diameter, which is attached to the end of the brake arm and serves to cut down vibration and yield a steadier reading at the scale. The end of the arm is connected with the scale and plunger by a U-shaped piece fitted with a fastening block and pin holes by which different attachment heights may be utilized to conform to differently sized motors and thus to maintain the balance arm in a horizontal position. Above the friction pulley an adjustable block with springs also contributes to the maintenance of steady running conditions through the helical springs shown near the left-hand end of the brake beam.

The brake arm itself is of oak, tapering in section from 1 in. x 1¼ in. at the right-hand end to 1 in. x 2 in. at the left. The friction pulley, 12 in. in diameter and 6 in. wide, is

provided with an opening at the end 7 in. in diameter through which water may be supplied to dissipate heat through evaporation. The pulley is designed to fit a split conical arbor which facilitates mounting on motor shafts of different size. Three pieces of automobile brake lining, each 2 in. wide, are used on the outside of the friction pulley and are controlled as to tightness against the pulley by a handwheel at the left, as shown. A small level taped in position on the brake arm facilitates keeping the latter horizontal when in use. The brake arm is cross-stiffened by ½-in. bolts spaced 6 in. apart.

E. Y. RICE,
Chief of Laboratory Staff.
Hartford Electric Light Company,
Hartford, Conn.

Trucks for Setting Poles Reduce Labor Costs

VERY satisfactory service has been obtained from the two types of pole-setting trucks illustrated herewith. For more than a year the Brooklyn Edison Company has used one of these, mounted on a Pierce-Arrow chassis of 3½ tons capacity, which is equipped with solid tires on all its wheels, those on the rear being dual.

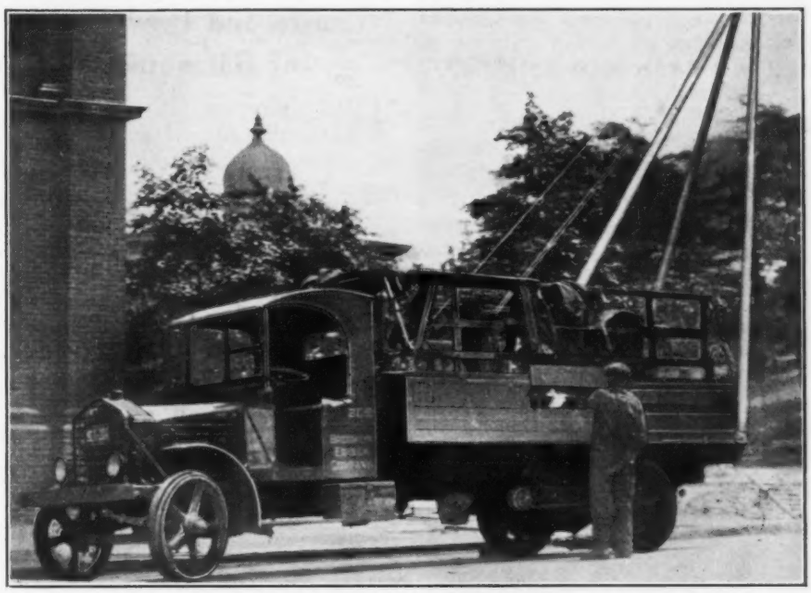
As will be noticed, the lower portions of the truck sides are taken up with lockers for tools, while above them are open frames from which can be hung coils of rope, etc. A winch, driven by the truck motor, is set up on the floor of the body just behind the driver's cab. Across the rear of the body there is bolted a heavy I-beam, and to this are bolted the two rear legs of a gin pole. This gin pole is made of 3-in. galvanized pipe, the legs being flattened at the ends and carrying a sheave at the top of the pole. The center leg is adjustable, the 3-in. pipe telescoping on one of a smaller section when necessary and being held at the proper height by means of a bolt and cotter pin. This allows sufficient extension to permit extending the gin pole straight out behind the truck, thus insuring its passing under any low bridge or other elevated structure that the truck itself can go beneath. With this truck the work of setting or removing a pole is but a matter of a few minutes after the hole has been dug.

POLE DIGGING AND SETTING TRUCK

The other truck is used by the Public Service Electric Company of New Jersey. The gin pole used with this truck has only two legs, the place of the third leg being taken by a wire rope which also raises or lowers the pole. This truck, which was made by the Winther Company, weighs 15,700 lb. without its load and has a loading capacity of 3,500 lb., making a total weight on the wheels of 19,200 lb., or almost 10 tons. Instead of the solid-rubber tires which are used on the Brooklyn truck, it is equipped with extra-large pneumatic cord tires, the rear wheels having dual tires similar to the Brooklyn Edison Company's truck.

Another point in which this truck differs from the one first described, as well as from most of the other pole trucks used, is that it is not only equipped for raising the pole after the hole has been dug but is designed to dig the hole. On the rear of the truck will be seen the large auger, driven from the truck motor, which bores the hole for the pole in the earth. By the use of trucks such as this the size of the gang of men needed to set a line of poles can be greatly reduced as compared with the older and more familiar ways of digging the holes and setting the poles.

G. H. MCKELWAY.
Westfield, N. J.



SETTING OR REMOVING POLES GREATLY FACILITATED BY USING A TRUCK OF THIS TYPE

Electric Heat Suitable for Drying Film Emulsions

FOR drying the emulsion on rotogravure films during their transfer to the printing rolls the Detroit *News* has recently installed an electric oven heated by twenty-four helical-core, sheath-wire air-heating units.

Very satisfactory results have been obtained with this installation due to the inherent characteristics of electric heat. The clear film on which the success of the picture depends is insured by the evenness of the heat distribution, the absence of contaminating gases from fuel and the freedom of the drying chamber from soot and dirt. A further advantage is the simplicity of the operation.

Air is heated by passing it through an insulated chamber containing the heating units and then circulated through the drying racks by a pressure blower. The heating units are

a recent development of the General Electric Company, each consisting of a helical coil of resistance wire firmly held in a steel sheath by a packing of powdered magnesium oxide. The terminals for connection with the power circuit project from each end of the tube. This tube is fitted with flat radiation vanes welded together and provided with screw holes for

RHEOSTATS REGULATING AMOUNT OF HEAT SHOWN ON TOP

mounting in any position desired. Rheostats regulating the heat are shown at the top and the method of air circulation is also illustrated.

The particular units comprising this installation are rated at 500 watts, 110/220 volts, and have a heating surface 20 in. long by 2 in. wide. The twenty-four units are so connected that by means of a rheostat from 12 kw. to 1.5 kw. may be obtained in steps of 1.5 kw. as desired. It is very easy to replace any unit or units, since by simply loosening the leads any section may be slipped out bodily without interference with the others.

W. S. BOOTH,
Assistant Business Manager,
Detroit *News*,
Detroit, Mich.

Causes and Prevention of Harmonics

THE circuits in which the harmonics appear and their amplitude with respect to other components of current and voltage may be controlled within certain limits. In general lower magnetic densities will decrease the harmonics produced but cause other difficulties of greater importance, among which are high cost and extreme weight of apparatus and also a change in the efficiency curves which will alter the operating losses and may or may not be detrimental, depending upon conditions.

The connection of the transformers has a very definite effect upon the place where the harmonics appear. Four common types of connections (delta-delta, delta-star, star-delta and star-star) are given in the accompanying table. It is assumed that the first-mentioned connection of the transformer is the primary and that the power flows from the first to the second connection.

Delta-Delta.—In this connection the harmonics in the magnetizing current produce an impedance drop in the primary winding. The generated voltage, and hence the flux, thus differ slightly from a sine wave. Therefore the voltage generated in the secondary will also differ slightly from a sine wave. The third harmonic and all odd multiples of three will appear as a circulating current in the secondary and will furnish part of the missing magnetizing current owing to the primary impedance drop and will tend to bring the flux nearer to a sine wave. With this connection these results are more theoretical than practical, as the harmonics appearing in the secondary voltage are so extremely small that they are difficult to detect even with sensitive instruments.

Delta-Star.—In the delta-star connection slight harmonics are introduced into the flux in the same way as described above. As the secondary is star, no circulating current can flow and there will be a slight third harmonic component in the voltage from line to neutral on the secondary side. This is still so small as to be practically negligible.

Star-Delta.—No third harmonic current can flow in the star-delta connection in the primary line if the neutral is isolated. The flux will then have missing a very large part of the magnetizing current required for sinusoidal form. This will appear as a third harmonic voltage in the secondary and will cause circulating current on that winding. This circulating current will be of the same magnitude as the third harmonic component of the primary magnetizing current for the delta-delta connection, when corrected by the ratio of turns. The third harmonic impressed upon the lines will be the impedance drop of this circulating current through one of the transformer secondaries.

Star-Star.—With transformers in star-star and primary neutral isolated, the worst conditions are encountered. The third harmonic magnetizing current is suppressed, as in the case of star-delta, and no circulating current can flow in the secondary to correct for this. Therefore very large third harmonic voltages will appear between line and neutral in the secondary but do not appear from line to line.

As mentioned, the magnetic den-

ANALYSIS OF HARMONICS APPEARING IN TRANSFORMERS

	Third Harmonic Magnetizing Current	Third Harmonic Voltage		Third Harmonic Current in Transmission Line	Inductive interference
		Amplitude	Location		
Case A (delta-delta)	Appears as circulating current in both windings, dividing inversely proportionally to the winding impedance	Equal to third harmonic impedance drop in windings	Occurs within both primary and secondary windings, but cannot be detected externally as it is absorbed in impedance	None	None
Case B (delta-star)	Appears as circulating current in primary winding only	Equal to third harmonic impedance drop in primary. Usually very small	Between lines and neutral in secondary and same as case A in primary	Flows from lines to ground if neutral is grounded. Proportional to admittance	Usually negligible
Case C (star-delta)	Appears as circulating current in secondary winding only	Equal to third harmonic impedance drop in secondary. Magnitude similar to last case B	Same as Case A in secondary; between lines and neutral in primary	None	None
Case D (star-star)	Absent	Depends upon characteristics of iron and magnetic density. May be large	Between lines and neutral both primary and secondary	Flows from lines to ground if neutral is grounded. Same as case B	May be quite large
Case E (star-star with tertiary delta)	Appears as circulating current in tertiary delta	Equal to third harmonic impedance in tertiary delta. May be fairly large, but usually less than D	Between lines and neutral both primary and secondary	Flows from lines to ground if neutral is grounded. Same as case D	May be large, but it is always less than case D, provided the characteristics of network are otherwise identical

sity of transformers can be reduced but is not desirable. Delta-delta and star-delta can be used, but both have objections from the operating standpoint. Delta-star connections with the delta on the primary side cause practically no trouble and are probably the best to use with transformers having two windings. Star-star connections are the worst if the primary neutral is isolated, but if the primary neutral can be connected to the generator neutral, the third harmonic magnetizing current is furnished through this connection.

Where this cannot be done, a transformer with three windings may be used, the third winding being known as a tertiary delta. The main windings are connected in star and the third winding in delta as implied. The third harmonic magnetizing component is furnished by the circulating current in this third winding. The third winding may be of any equivalent voltage, but must be of fairly large capacity for two reasons: First, if a large unbalance occurs upon the line, the third winding will have to carry a large amount of circulating current of fundamental frequency and will burn out if not of sufficient capacity; second, the third harmonic appearing in the secondary voltage will depend upon the impedance drop in the third winding caused by the triple-frequency circulating current, and it therefore must be of low impedance. The magnitude of the third harmonic appearing in the secondary may be estimated in a similar manner to that described under the delta-star connection where the impedance of the tertiary delta is taken instead of that of the primary winding.

There is a tendency to use transformers of high impedance owing to the current-limiting features. The effect of this high impedance upon the third harmonic produced in the secondary will depend upon the connections used and upon which winding has the larger impedance. Thus in the delta-star case the impedance of the secondary is immaterial and the impedance of the primary determines the third harmonic present.

The third harmonics appear chiefly between the transmission wires and ground and therefore depend upon the admittance of line to ground and will vary with the length of the connected transmission line. The same exposure with a short line would not give the same amount of interference from this cause as with a long line, the transformer connections being identical, and the interference on a long line would be greater with the exposure at the generator end than at the other end. Local conditions might vary these facts, so that they must be considered as guides rather than exact rules.

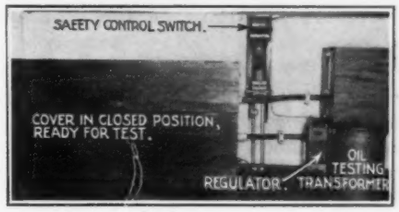
The above information was taken from a paper by the author that was included in the 1922 report of the N. E. L. A. inductive interference committee.

F. S. DELLENBAUGH, JR.,
Secretary Research Division.
Electrical Department.
Massachusetts Institute of Technology.
Cambridge, Mass.

Testing Rubber Gloves with Safety and Ease

A SAFE and convenient equipment for the testing of rubber gloves has been developed by the Houghton County Electric Light Company. This apparatus, which has given very satisfactory results for more than a year, is shown in the accompanying illustrations. Its safety features obviate the necessity of a special laboratory and a skilled operator. Six gloves may be tested at a time with this equipment.

A 3-kva., zero-to-30,000-volt oil-testing transformer is used to supply the necessary test potential of 10,000 volts. This transformer is equipped with a regulator having a calibrated voltage dial making it possible to vary the voltage from zero to 30,000. A circuit breaker is mounted on the regulator and is set to give proper protection to the milliammeter. The transformer contains a grounded voltage coil with taps

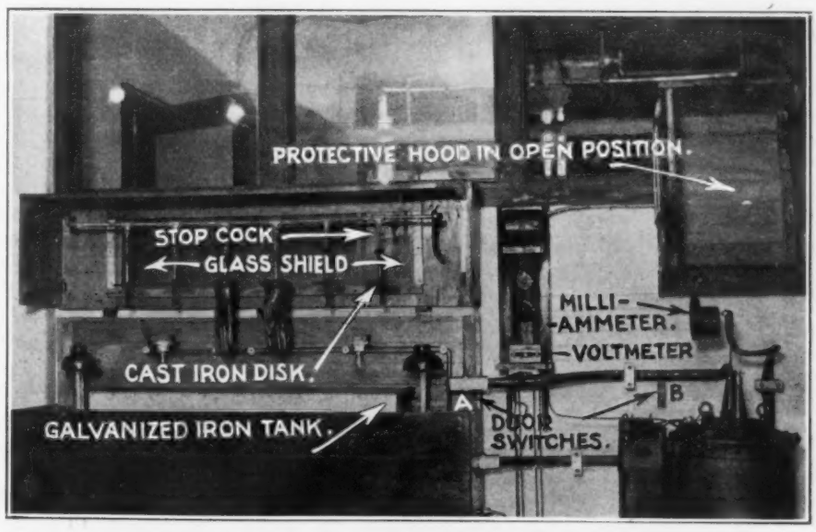


GLOVE-TESTING EQUIPMENT READY FOR MAKING TESTS

brought out, to which is attached a direct-reading voltmeter which measures the drop in potential across the gloves being tested. All high-tension terminals are covered with a protective hood.

The glove-testing equipment consists of a galvanized-iron water tank supported on insulators and an insulated galvanized-iron water pipe which is provided with six detachable glove-holding taps. This is all inclosed in a wooden box, and when the cover is closed it is impossible to come into contact with any live parts. The water pipe is provided with a detachable funnel, which is attached only when the gloves are being filled with water. Each of the six taps is equipped with a stopcock, a union connection and a cast-iron disk upon which the glove is supported. High-tension insulated leads are brought in through porcelain bushings at the right end of the box, one lead being attached to the tank and the other lead to the water pipe.

The top of the wooden box is provided with a glass shield protected, when not in use, by a hinged cover. This feature, together with the lamps which illuminate the interior, facilitates observation of the gloves under test. The tank is filled with water to



FROM SERVICE AND INVESTMENT STANDPOINT THIS GLOVE-TESTING APPARATUS IS WELL SUITED TO THE AVERAGE COMPANY

a level 1½ in. from the top of the gloves.

When the gloves are mounted and ready for testing the cover is lowered, closing door switch *A*. The protective hood is then lowered, closing door switch *B*. Next, the circuit breaker on the transformer regulator is closed, and finally the safety control switch is closed. All switches, as shown in the wiring diagram, are in the primary low-tension circuit, and the circuit cannot be made alive until all switches have been properly closed by the operator.

The potential between the inner and the outer surface of the gloves is measured by a voltmeter which is furnished with the transformer. A milliammeter connected in the high-tension lead measures the leakage current. In making the test all

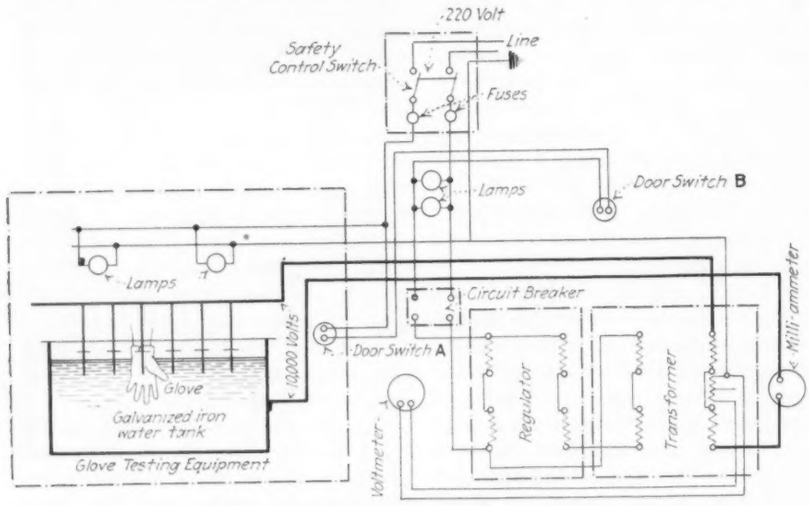


DIAGRAM OF GLOVE-TESTING EQUIPMENT GIVING POSITIVE RESULTS THAT IS SAFE AND EASY TO OPERATE

gloves are subjected to breakdown and leakage tests at the same time. Any faulty glove can be removed readily from the circuit when it is found to be bad.

A test of from three to five minutes at 5,000 volts is made, and readings of voltage, leakage current in milliamperes and duration of test are recorded. Then a test is made at 10,000 volts for a period of one minute. If at no time during the test the leakage current exceeds 8 milliamperes per glove, the gloves are "O. K." It has been found by test that faulty gloves usually puncture. If this is not the case, the unusual disturbance in the water in the immediate vicinity of the glove indicates excessive leakage current.

P. W. WILDER,
Distribution Superintendent.
Houghton County Electric Light Company,
Houghton, Mich.

Systematically Sampling Delivered Coal

IN SAMPLING delivered coal the Bureau of Mines follows a definite procedure. A sample weighing not less than 1,000 lb. is systematically collected by taking equal increments at regular intervals throughout the delivery, while the coal is being loaded or unloaded, and then crushing and reducing this sample by successive stages to laboratory size before making any tests.

In using analyses of samples of delivered coal it must be recognized that the coal is not always of uniform size and that the impurities are not uniformly distributed throughout the mass. Some variation in the results obtained are consequently to be expected. Even if the same mass of coal were sampled a number of times the analyses would not agree absolutely except by chance. It is only when a considerable number of such analyses are available, representing a considerable tonnage mined over a period of time, that the average value and range of variation of a particular coal become known with assurance. With reasonable tolerances, however, for these variations, delivered coal can be sampled accurately enough for all practical purposes.

Deliveries from any one mine may vary in quality from time to time because of changes in mining or preparing the coal, and an analysis of deliveries for any one date should not be considered as establishing a permanent standard, for the output may be greatly improved by new methods of mining and preparation, or it may deteriorate through the carelessness of the miner and the operator.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Cost Data Again Available for Eastern Utility

THE following significant cost data for substation equipment were recently prepared by an Eastern utility in connection with a summary of plant additions since 1915. In each case except where noted the figures represent the cost of the equipment plus the installation cost. Cents have been omitted, and in general the costs include the complete provision and installation of the listed apparatus:

Replacement of three 200-kw. transformers with one 1,500-kw. three-phase transformer, including necessary changes in instrument equipment, knife switches for lightning arresters and cartridge fuses for 13,200-volt potential transformers	$7,383
Installation of one 1,500-kva., three-phase air-blast transformer with control equipment	8,298
Same without control equipment	7,085
Installation (only) of three 5,000-kva. outdoor transformers, 22,000/69,000 volts, three-phase, complete with switching equipment for two transmission lines	678
Installation of one 2,250-kva. rotary converter with complete alternating-current and direct-current control equipment, and equipment for five new direct-current feeders	39,122
Installation of one 1,000-kw. rotary converter to replace 500-kw. motor-generator set	19,203
Installation of switching, instrument and wiring equipment for new No. 4/0 split-conductor, 15,000-volt power distribution circuit	3,406
Installation of switching, control and wiring equipment for two new No. 4/0 split-conductor 15,000-volt transmission lines	6,776
Installation of one 30-gal. electric hot-water heater in place of steam-heated tank	460
Installation of a 2,000-kva. rotary condenser, 600 volts, three-phase, 60 cycles, with switching and instrument equipment	11,259
Installation of one 75-light mercury-arc rectifier, 6,600 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, lightning arrester and bus connections, installed	2,760
Installation of one 75-light mercury-arc rectifier, 13,200 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment and lightning arrester	2,924
Installation of one 40-kw. "T" regulator in a circuit on line side of potential transformer	1,511
Installation of two 23-kw. I.R.S. automatic regulators, in two circuits with wiring	1,838
Installation of 35-kw. I.R.T. regulator with complete equipment in one circuit	2,004
Installation of a 7.5-kw. pole-type transformer, 2,400/1,200/240/120 volts, connecting primary coil into secondary side of tube, carrying two circuits throughout, and connection of transformer inside of the short-circuit plugs so that it can be used in place of either circuit; the secondary ends of the transformer were left open and taped, primary connected for 1,200 volts	139
Installation of a synchroscope with lamps on swinging arm or bracket on a 13,800-volt switchboard, connecting the synchroscope with the upper and lower bus potential transformers through fuses and double-pole knife switches	112

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Should Distance from Plant Fix Rates?

Rate Committee of Utility Commissioners Opposes This Principle and Shows the Difficulty that an Attempt to Enforce It Would Cause and the Disadvantages that Would Follow

STRONG opposition to the principle laid down recently by the Supreme Court of Wisconsin that communities adjacent to a source of power are entitled to lower utility rates than those at a distance was voiced at the convention of the National Association of Public Utility Commissioners held in Detroit recently by its committee on utility rates, of which Lewis E. Gettle of the Wisconsin Railroad Commission is chairman.

The committee asserted that if cities near a source of power are to have this advantage the results will be discrimination against other communities and the retarded development of water-power resources. The cities favored will have an unfair commercial advantage over other cities in their efforts to obtain factories, and rates in cities farther removed from power sources will tend to be too high. It was also asserted that commissions would not be able to administer such a law properly.

"The Wisconsin Supreme Court has recently held in a case of this kind that communities adjacent to the source of power are entitled to more favorable rates than those at a distance," said Chairman Gettle, speaking for the committee. "While the decision of the court does not so state, it seems to be a fair inference that this means that the cost of getting the energy to outlying communities must be assigned in its entirety to those places. It overlooks the fact that if this means that the rate is unreasonably high in those communities—and that must be judged not only by the cost of serving them from the hydro-electric plant, but by the value of the service to the localities—the market will be restricted and cities close to the sources of power will have to carry more of the cost.

"This committee takes the position that proximity of a city or village to a water-power development should not give it a priority of interest in that development. The present-day electrical business is a business of transmission as well as of local distribution, and the benefits of water-power development should be made available within economical transmission distances to all who can be served. This means that the local community cannot be the unit for the assignment of costs upon which rates are based, and we submit that there is no logical reason why a city or village should be the unit in preference to an entire section of the state or of the country.

Grouping Communities

"Its treatment as a unit is merely a survival from the days when the theory and the practice coincided and when the utility supplying each city was separate and distinct from those supplying other cities. There are considerations of public policy as related to the development of the natural resources represented by our water powers which not only justify the grouping of communities into a single unit for rate-making purposes but make such grouping of foremost importance.

"We do not mean by this that there are not elements which will justify the differences in rates in the communities served from a hydro-electric plant, but we believe that distance is not the controlling element nor even one of the important ones, provided the distance is not so great that the cost of reaching the city throws a burden upon other cities supplied. Unless hydro-electric properties can develop their natural market in public utility service within economical transmission distance they must either throw a burden upon the communities near the source of power, carry the loss themselves, or market large blocks of their power at any price available, assuming that even that market can be had.

"It is not unusual in the development of water-power projects to have the surplus of power over that required in the utility service marketed wherever it can be sold and at whatever price is available. Normally this is a price so low that a better market would be obtained if all the energy could be sold to the regular customers of the company in the villages and the cities which it supplies. Rates should be so adjusted among the cities supplied that the uneconomical marketing of energy through the sale of amounts not required in the utility service will be as small as possible. The more completely the available power can be marketed in the general service of the utility, the more widely is the cost of supplying the utility service distributed and the smaller is the cost on each unit of product sold.

"While we take the position, therefore, that the development of water powers in the interest of the public precludes the acceptance of any idea of priority of right to the energy developed based on geographical location, we do not take the position that rates in all cities and villages served should be the same. Such a position would ignore many elements which have a bearing upon the reasonableness of the rates to be charged. The size of the city to be served, the economy with which it could be served by other sources of power, the character of the distribution system made necessary to meet local requirements—all these and other elements may make rates proper in one community different from those in another, but these are differences based upon local conditions and not upon advantages or disadvantages in the way of proximity to the source of power.

Conclusions of the Committee

"The suggestion of the committee amounts then to this:

"That the transmission lines which make possible the delivery of the energy generated by water power plants to the communities in which

it is to be used should be treated to all intents and purposes as if they were part of the power plants. The power system could not exist without the market and the facilities which make it possible to reach the market, assuming that good business judgment has been exercised in their construction, must in practice be regarded as part of the power system and the costs incident to transmission be regarded as part of the power costs, or else there will be many instances in which the development of hydro-electric plants will be delayed awaiting the growth of a nearby market, if not prevented altogether.

PROPER BASIS OF RATE FIXING

"Although the committee is more concerned at this time with presenting the general problem which has been discussed than it is with the practical difficulties of apportionment of expenses, we as members of state commissions which have to deal with this matter cannot overlook the great practical problem of how we are to determine the cost in each community if the city or village must be the unit. Often several hydro-electric plants are connected to the same transmission system so that it is impossible to tell where the energy supplying any particular city has been generated. Furthermore, in the construction of transmission systems, what may be called the loop type of construction, where the lines form a complete circle, is very often employed. Energy supplying a particular city may be delivered from either one side or the other of the loop. No one can determine how much of it comes from one direction and how much from the other. No one can determine how much demand is made for energy from one direction and how much from the other. Under these conditions anything approaching an accurate assignment of transmission costs on a basis which recognizes the distance element is utterly impossible, and if the law requires that the difference in cost resulting from difference in distance from source of supply must be the basis for differences in rates among communities, that law cannot be administered properly.

"There is also a commercial element to be considered in such cases. Industries within the territory supplied from a large water-power plant are often in competition with one another. Cities are in competition with each other to obtain factories. There are, of course, certain local types of industries which cannot move from city to city and in the original location of which in a given city the cost of energy has not been an important consideration, but there are other industries, particularly the larger ones, not dependent on local market, which, if other things are equal, will locate where energy can be obtained most cheaply. It seems to us that rates which will not give a material competitive advantage to an industry in one city over a similar industry in another city supplied from the same source of power are proper rates if the only criticism which can be made of them is that the distance factor has been left out of consideration. Also, we believe that the development of water powers is intended to be for the general good of the people who can reasonably be served from those powers, and that the market for the energy should be such that no one community will be given a great competitive advantage over others in securing industries because of its proximity to the powers.

"The interest of the state or of the entire geographical section which can be served from a hydro-electric plant ought to be paramount to the interests of any particular community in that section. Rate regulation which is based upon this principle will be unpopular in the communities which are situated near the source of power. Conversely, it may be assumed that it should be popular in other communities, but aside from the matter of popularity it will permit the broadest possible service to the greatest possible portion of the public, and this, we think, is one of the most important things to be taken into consideration in fixing public utility rates."

Industrial Electric Trucks in New England

CONTRARY to the opinion held by a number of central-station men and sales representatives of industrial electric tractor and truck manufacturers, a fair number of these equipments are now in service in New England and are supplied with central-station energy. From confidential sources a representative of the *Electrical World* was informed recently that from 100 to 150 industrial electric trucks and tractors are now being charged daily by central-station energy in these six states, and that from about 33,000 kw.-hr. to 45,000 kw.-hr. a day is absorbed in this service.

Ten representative industrial truck users have fleets aggregating about fifty machines, and this embraces a wide variety of applications, including steamship pier transportation and material handling in paper, fertilizer, rubber-goods and metal-working plants and in railroad yards. Though it is true that many more industrial trucks and tractors are in service in mills operated by isolated plants of considerable size, the number of trucks in central-station service is increasing and the beginning of a more active co-operation between the power engineering departments of the central stations and of the various truck and accessory manufacturers appears to indicate better business in the coming year.

Tact in Requesting Deposits from Customers

BY HENRY BOSTWICK
San Francisco Division Manager, Pacific Gas & Electric Company

USUALLY the central station company's first contact with a new consumer is through the credit department, where the customer must make credit arrangements for service. In many cases it is necessary to ask the new consumer for a deposit to guarantee payment of bills, and here is where many friends are made or lost for the company. From the credit man's standpoint it is hard to see why any one who has not used the company's service before and who has no credit rating and who cannot get a responsible person to sign the contract as guarantor should feel offended when asked to make a small deposit, on which the company pays a fair rate of interest, to guarantee payment of the account. Nevertheless, no matter how tactful the credit man may be or how carefully he may explain the reasons for requiring a deposit, the customer feels that his or her honesty has been questioned and immediately assumes a hostile attitude. If finally forced to make a deposit, the citizen goes away with a feeling of ill will toward all utility corporations.

Instead of refusing to supply service until satisfactory credit has been established, the Pacific Gas & Electric Company of San Francisco gladly accepts the customer's application and installs service on the date requested. Then, if a deposit is re-

quired, a few days after connection has been made the following carefully worded letter is sent out:

In relation to the gas and electric service now being rendered at the above address:

Please be advised that, pursuant to the rules and regulations governing our service, it will be necessary for you to deposit with the company not later than [date is here given], in order to insure the prompt payment of bills monthly, the sum of $5, $2.50 to be applied as a deposit on your gas service and $2.50 to be applied as a deposit on your electric service; or in lieu thereof the company will accept a guarantee signed by a responsible party, preferably a property owner. Deposits are returned after the expiration of one year with interest at the rate of 6 per cent, provided all bills during the interim are paid promptly.

Kindly give this your attention, favoring us with the deposit requested or furnishing a proper guarantee as suggested on or before the expiration date mentioned herein, thereby avoiding our service to you being disconnected.

Division Manager.

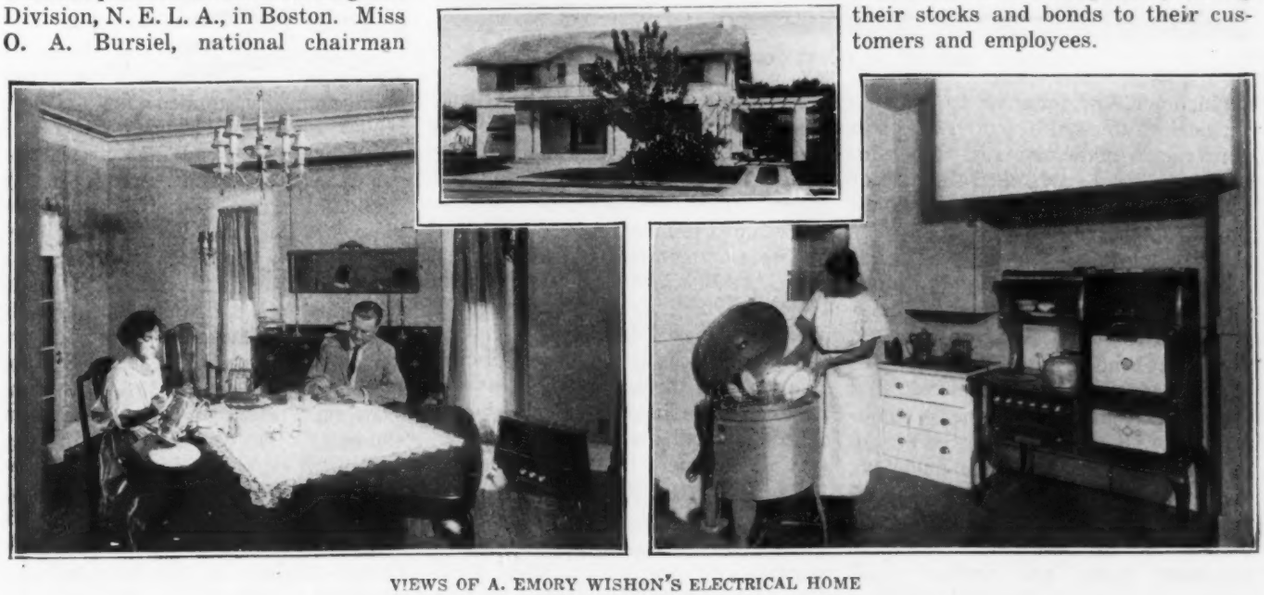
Of course, where the customer has no objection to making the deposit it is collected at the time application is made for service. In most cases, however, the company shows that it is willing to trust to the customer's honesty for fifteen days or until a time when it is perhaps more convenient for him to make the deposit.

New England Women Start Public Information Work

WITH 100 per cent attendance, the first meeting of the recently organized New England division of the Women's Public Information Committee was held recently at the headquarters of the New England Division, N. E. L. A., in Boston. Miss O. A. Bursiel, national chairman women's public information committee, and H. T. Sands, chairman national public relations committee, were present, the latter giving an informal address upon public relations. Miss G. M. Thibodeau of the Malden (Mass.) Electric Company is chairman of the New England committee, the other members being Miss A. M. Baker, Hartford Electric Light Company; Miss Marie Clement, Blackstone Valley Gas & Electric Company, Woonsocket, R. I.; Miss G. R. Colby, Bangor (Me.) Railway & Electric Company; Miss M. Goggin, Twin State Gas & Electric Company, Boston, and Mrs. E. M. Everett, Edison Electric Illuminating Company of Boston.

Central Station Manager Practices What He Preaches

HERE is a case where a central station manager believes so thoroughly in the electrical home idea that he owns one himself. This is the new home of A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation, in Fresno, Cal. In addition to 263 outlets, it contains almost every kind of electrical appliance known to the industry. The example set by the central station men showing that they believe in the electrical home has resulted in building up a residential section in Fresno where nothing but homes that are fully equipped with adequate convenience outlets and modern wiring are built by the general contractor.



VIEWS OF A. EMORY WISHON'S ELECTRICAL HOME

Utility Executive Lectures at School of Journalism

INCLUDING public utility problems as part of the course of study has become the practice of many colleges and universities, and a practical application of this policy is seen in the recent lecture on the fundamental principles of the public utility industry by George A. Davis, assistant to the vice-president of the Oklahoma Gas & Electric Company, before the University of Oklahoma's School of Journalism. Mr. Davis explained how many of the prejudices against public utilities have been inherited from the days before commission regulation, when the investment risk was considered much greater than under the present system. Naturally this made it necessary to charge rates high enough to cover such an element of uncertainty. With state regulation the investment of the utility has been stabilized and protected, while the public also is protected against unreasonable rates and profiteering.

"While the business man turns over his entire capital from three to five times a year," said Mr. Davis, "the average public utility company must carry on its business at least five years before its gross revenue for that period equals the amount it has invested.

"Some people believe that there is an underground connection of some kind between the public utilities and Wall Street. This is far from true. The largest stockholders of public utility securities are the insurance companies. Many public utilities secure much of their capital by selling their stocks and bonds to their customers and employees.

"Regarding the popular fallacy of watered stock, I do not believe that there is a nickel's worth of watered stock among the public utilities in Oklahoma. Further, public utility rates are not based on capitalization of the company, but upon valuation of the physical property which is used and useful in serving its patrons. The corporation commission or some other regulatory body makes an appraisal of the property of the utility and then, besides allowing the company to earn only a fair rate of interest on its investment, also makes allowance to cover depreciation of the property and taxes."

Utility Aids Contractors to Trim Windows

ALONG with its policy of assisting electrical contractor-dealers, the Commonwealth Edison Company is maintaining a window-trimming service, which consists of sending a trained window trimmer to contractor-dealers to teach them how best to construct window displays. Much interest has been aroused on the part of the dealers, who are eager to obtain pointers whereby they can improve their windows.

WINDOW TRIMMED AS MODEL FOR CONTRACTORS

At one of the recent weekly dinner meetings which the company is holding for these contractor-dealers Mr. Johnson, head window trimmer for the Edison company, demonstrated the effectiveness of properly trimming a window, erected in the dining hall, with material costing only $25. This material consisted solely of 15 yd. of red satin cloth, one Christmas wreath, a cotton-covered sheet to represent snow, and several small cartons or boxes. Special attention was directed toward the fact that all this equipment could be obtained with but little expense from material in the dealer's store room. With this material three trims were obtained which would provide a new window every two weeks until Christmas time.

What Other Companies Are Doing

Salem, Mass.—Within the past six weeks the Salem Electric Lighting Company has closed 121 contracts for house wiring on existing lines, including 2,300 outlets and 157 meters. Special attention has been given to the wiring of old residences. The work is being done on the basis of $5 down and two years to complete payments, the central-station company financing the project. Direct-by-mail solicitation has been effective in this campaign, which is vigorously continuing.

Milwaukee, Wis. — The Utility Securities Company of Chicago has opened a branch office in Milwaukee under the management of John E. Miles. This company is the outgrowth of the investment department of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the Middle West Utilities Company, all having executive offices in Chicago. Securities of these three companies, as well as of their subsidiaries, will be offered in small amounts, particularly to the customers they serve.

Chicago, Ill.—Remarkable expansion in properties and substantial growth in business are shown in statistics of the Middle West Utilities Company and its twenty-six subsidiaries, just compiled. The report shows that on Oct. 1 the number of customers served totaled 387,354, a gain of 55,233, or 16.6 per cent as compared with Oct. 1, 1921. Connected electric load was 526,715 kw., an increase of 102,201 kw., or a 24.1 per cent gain for the twelve-months period ended Oct. 1. Sales of appliances for the nine months of 1922 ended Oct. 1 totaled $1,034,110, a gain of 17.6 per cent over the corresponding period in 1921. The subsidiaries of the Middle West Utilities Company serve directly, by means of their own distribution systems, 633 cities and towns. In addition they serve indirectly 174 other communities under wholesale contracts. This makes a total of 907 communities served in fifteen states.

Cleveland, Ohio.—The Electrical League of Cleveland has issued an eight-page pamphlet, entitled "Home Wiring Suggestions," which contains floor plans for every room of a modern house, showing the proper disposition of an adequate number of convenience outlets. Persons who contemplate building new homes have been invited to submit their plans to the league office for free advice on wiring, lighting equipment and appliances.

Boston—Plans are rapidly maturing for the establishment of a series of electric homes at Boston under the co-operative activities of local jobbers, contractor-dealers and central stations. Arrangements have been made with the Bonelli-Adams Company, a prominent real estate organization, to equip three residences now under construction for electric service and to demonstrate these applications until the houses are sold, fully furnished from the electrical standpoint. Lectures will be given upon domestic applications of electricity at these homes. Suburban central-station companies are interested in the development with the Edison Electric Illuminating Company of Boston. The preliminary committee is composed of H. B. Gilmore, Western Electric Company, Inc., Boston, chairman; F. S. Price, Pettingell-Andrews Company, Boston, and H. M. Savage, Wetmore-Savage Company, Boston. W. H. Atkins, general superintendent Boston Edison Company, is co-operating in the movement on behalf of this organization. It is expected that the first electric home will be opened in March, 1923. Other homes in different sections of the city will be operated later.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station at Herlandsfossen, Norway.—A. TRABER. — This 14,000-hp. station serves as an auxiliary to the main power supply of the city of Bergen. The plant contains four totally inclosed, horizontal-shaft generating sets of 3,500 hp. each. Two lakes with a drainage area of 24 square miles furnish the water supply under a head of 460 ft. A unique feature is the high-pressure line from the water-collecting tower to the turbines, which is drilled into the solid rock and used without any additional lining. Francis-Type turbines of 600 r.p.m. drive 3,200-kva., three-phase, 10,500-volt, 50-cycle generators. Large air impellers, mounted on each side of the rotor, provide excellent air cooling for the machine. The combined friction and windage losses of each generator amount to 30 kw. at full speed. At rated load and unity power factor the machines have an efficiency of 96 per cent. After a ten-hour full-load run the following temperatures were observed: Armature winding, 97 deg. F.; field winding, 59 deg. F.; air, 38 deg. F. The machines are designed to withstand safely an excess speed of 80 per cent.—*Bulletin Oerlikon*, September, 1922.

New Generating Plant at Nelson, England.—A description of the extension plant consisting of two 3,000-kw. standard Brush-Ljungstrom sets, each designed to operate at a pressure of 200 lb. per square inch superheated to 620 deg. F. and exhausting into a vacuum of 28½ in. of mercury. Each set runs at a speed of 3,000 r.p.m. and is capable of an overload of 25 per cent for two hours.—*Electrical Times*, Oct. 19, 1922.

Stack Height to Supply Draft Power.—H. MISOSTOW.—The latest boiler developments have greatly increased resistance to draft in the fuel-bed and air passages. The stack in addition to conveying gases must act as a generator of power for operating the boiler. The connected load and mechanical efficiency are among the subjects discussed.—*Power*, Oct. 24, 1922.

Generation, Control and Switching

Eddy-Current Losses in Conductors of Electric Machines.—H. RIKLI.—To avoid large eddy losses in heavy copper or aluminum conductors of machines and transformers, it is customary to subdivide each conductor into a number of small conductors insulated from each other and used in parallel. A simple formula is developed which, in conjunction with two curve sheets, gives the designer of machines a very exact means by which to choose the cross-section of a winding of a machine with a minimum of eddy losses. The method of using this formula is illustrated by several examples, both for machines and for transformers.—*Bulletin Oerlikon*, August, 1922.

Turbine Development.—G. MOLINDER.—The author gives a résumé of the hydraulic researches of Dr. Kaplan, which led to a departure from standard turbine design for the purpose of increasing efficiency at high specific speeds. The result of these investigations was a new turbine, usually called the Kaplan turbine (in America sometimes the Nagler turbine). The Kaplan turbine has a minimum of wet surface. There are only four, and sometimes only two, narrow blades and no external ring. This feature makes for low losses even at high speeds. Furthermore, the turbine can easily be built with adjustable blades, and thus the losses due to rotation in the draft tube can be cut down practically to zero. A third feature is the peculiar draft tube, which so efficiently converts velocity into pressure that the Kaplan turbine may be said to work with more than the actual head, the excess being paid back by the draft tube. The article includes a description of some large Kaplan sets for the power plant at Lilla Edet, Sweden. These turbines each consist of one single, adjustable, four-blade propeller, measuring 5.80 m. in diameter, and will develop 10,000 hp. each, at 62.5 r.p.m. at a net head of 6.5 m.—*Teknisk Tidskrift*, Sept. 16, 1922.

Units, Measurements and Instruments

Laboratory Apparatus for Technical Schools and Colleges.—F. S. WHEELER.—Laboratory apparatus should consist of standard equipment as far as possible, and where it is necessary to provide special pieces standard mechanical parts should be used wherever practical. Since the small synchronous motors and generators of the revolving-field type are not typical of the larger machines in construction, a 15-kva. maximum-rated, 220-volt, three-phase, 60-cycle, 1,200-r.p.m. revolving-field synchronous machine has been developed to meet the general requirements for laboratory work. This machine may be provided with either of two windings. One is a 220-volt, three-phase, 60-cycle winding which may be connected for one, two, three, six or twelve-phase operation, and the other is a 110-volt or 220-volt series-parallel, three-phase, 60-cycle winding, which is connected for one, three or six-phase operation. A complete description of this machine is given. A phase advancer, a generator panel and a laboratory generator-motor set suitable for technical schools are also described.—*Electric Journal*, November, 1922.

Transmission, Substations and Distribution

• *Current-Carrying Capacity of Cables When Intermittently Loaded.*—The size of cable should be chosen on the basis of time-constant and not of the root-mean-square current. The time constants for standard rubber-insulated cables have been obtained mathematically and curves prepared for determining the short-time overload factor. The pressure drop, however, must not be overlooked. A set of curves is included that has been made for finding the maximum allowable length of the line.—*Brown-Boveri Review*, October, 1922.

Transmission-Line Relay Protection.—A fourteen-page article describing the transmission relay protection outlined by the protective devices committee of the A. I. E. E. at the Niagara Falls convention. A three-page abstract of this article may be found in the *Electrical World* for July 8, 1922, beginning on page 66.—*Journal of the A. I. E. E.*, November, 1922.

Illumination

A Survey of Residence Lighting.—Two papers, by M. Luckiesh and N. D. Macdonald respectively, that were presented before the Swampscott convention, surveying the status of residence lighting and outlining the opportunities for development. Mr. Luckiesh collected information by questionnaire and Mr. Macdonald by means of surveyors. Abstracts of these two papers and some of the discussion upon them may be found in the convention report printed in the *Electrical World* for Oct. 7, page 758.—*Transactions of the I. E. S.*, October, 1922.

Lighting in Woodworking Plants.—A. D. BELL.—The use of general and localized-general systems of illumination in woodworking plans is discussed, attention being paid to the intensity required for the various operations and the manner in which lighting units should be placed. Concrete data are given, taking up each process through which the wood goes from the tree to the finished article.—*Industrial Engineer*, November, 1922.

Motors and Control

Properties of the Distribution Factor of Armature Windings.—B. HAGUE and S. NEVILLE.—The principal mathematical properties of the distribution factor are discussed, and a complete series of curves exhibiting these properties in a form suitable for practical application is given.—*Institution of (British) Electrical Engineers*, Vol. 60, No. 312.

Factors Affecting the Selection of Electric Motors for Steel-Mill Auxiliary Drives—Part II.—L. A. UMANSKY.—By means of specific examples the author explains the method of calculating the performance of a motor-driven reversing mill table, including friction, acceleration, duty cycle, plugging and the influence of gear ratios.

It is intended in these articles to show how the calculations required to make the application of the electric motors in the steel mill are a matter of engineering and not of guesswork.—*General Electric Review*, November, 1922.

Operation and Maintenance of Electrical Equipment.—L. C. ILSLEY.—A permissible schedule of the Bureau of Mines establishes certain minimum standards for safety and gives details of test methods adopted to determine whether these standards have been met. A list of charges for such tests is also given. Recommendations that apply to the operation and maintenance of nearly all makes and classes of apparatus are outlined.—*Technical Paper No. 306, Bureau of Mines.*

Gasoline-Electric War Tank.—M. DUTHIL.—The author gives a very interesting and unusual description of the equipment and the characteristics of a French war tank with gas-electric drive. During the war four hundred of these tanks were used by the French armies.—*Bulletin de la Société Française des Electriciens*, Vol. 2 (fourth series), No. 17.

Heat Applications and Material Handling

Electric Coal-Conveying System.—M. DRUEY.—To fill automatically the main coal bunkers of the power house of a large steel mill, an unusual electric conveying system has been installed. It is described in this paper. The buckets each hold 900 lb. of coal, and run underslung along an elevated rail system. The two running wheels are driven by a small, direct-current motor, which collects the current with a short trolley pole from a 110-volt overhead wire. The average speed of the bucket is 300 ft. per minute, and there are curves with as small as 6-ft. radius to be passed. The total traveling distance of the buckets is 1,320 yd., arranged in the form of a closed loop. As there are six buckets traveling, a total of about 11 tons of coal can be conveyed hourly. An interesting automatic blocking system is in use to prevent collisions between the buckets. The overhead trolley wire is divided into a number of sections, which are energized or opened by the passing of a bucket along the sections of the conveyor system.—*Bulletin Oerlikon*, October, 1922.

Electrophysics, Electrochemistry and Batteries

Properties of Cold-Worked Metals.—ZAY JEFFRIES and R. S. ARCHER.—The properties of cold-worked metals are explained by a series of postulates regarding conditions at slip planes. The general theory is checked by experiments on copper, nickel, iron, molybdenum and tungsten.—*Chemical and Metallurgical Engineering*, Nov. 1, 1922.

Electrolytic Copper Extraction Process.—W. E. GREENAWALT.—Details of a proposed process in which the major part of the reduction of ferric salts is accomplished with sulphur dioxide, the remaining reduction being effected with copper sulphide obtained by precipitating the lean and foul solutions with hydrogen sulphide. The various advantages of the process are discussed.—*Engineering and Mining Journal-Press*, Oct. 21, 1922.

Traction

The Trackless Trolley.—M. IGLESIS and M. DUTHIL.—A very elaborate sixty-eight-page study of the development of the railless type of electric street cars of all countries of the world. This paper represents one of the most complete accounts written of the many types of trackless cars known and used the world over. Besides a very detailed description of the cars, the author gives exact comparative cost figures of the different systems, according to the density of the traffic, the cost of electrical energy and the radius of operation. On account of its completeness, this article will no doubt be of great value to the designer of this type of street cars.—*Bulletin de la Société Française des Electriciens*, Vol. 2 (fourth series), No. 17.

Electrification of Austrian Railroads Planned.—R. MOSSMAN.—The serious need for coal, which must be purchased at high prices from other countries, has been the controlling factor in the determination to change from steam to electricity on Austrian railroads. The most important problem is to utilize the many existing watersheds in suitable hydro-electric stations. The plan contemplates the electrification of the main line from Innsbruck and Bregenz to the border, including all of its branches. This will be completed by June, 1925, according to the proposed program.—*Electric Railway Journal*, Nov. 4, 1922.

Telegraphy, Telephony, Radio and Signals

Triode Oscillator Theory.—EDY VELANDER.—A general formula, the so-called oscillator equation, is developed which enables the frequency and the oscillating condition of any one-tube triode oscillator be easily determined without the use of differential equations. By the use of this formula any oscillator problem may be resolved into an elementary determination of the network constants. This equation splits into two parts, one real, giving the frequency of the oscillator, and one purely imaginary, leading to the condition for stable oscillations of small amplitude. The same equation approximately holds for larger amplitude, provided the effective values of the tube constants are considered as functions of oscillating current amplitude. As examples of the use of the method, the article shows how the oscillator equation may be applied to a number of simple triode oscillator problems.—*Teknisk Tidskrift*, July 8 and Sept. 9, 1922.

Relay Automatic Telephone System.—This automatic system does away with all electromechanical switching devices, and even successive group selection is only utilized to a limited extent. It is built up entirely with relays. All operations in the exchange, inclusive of circuit hunting, connecting and ringing, are executed by means of relays without the intervention of any mechanical gear. The article deals chiefly with the main principles of the system and method of assembly, with particular reference to private automatic exchanges suitable for offices, factories, ships, railways, etc. Some information relative to larger exchanges designed for public service is, however, added in conclusion. The system embraces facilities for accommodating private branch exchanges and working over junctions to other exchanges in addition to caring for numerous special services, each of which is outlined in the article.—*Engineering*, Sept. 29, Oct. 6 and Oct. 13, 1922.

Commercial Radio Telephone and Telegraph Transmitting Equipment—Part II.—W. R. G. BAKER and B. R. CUMMINGS.—In Part I, appearing in the previous issue, the authors explained why the continuous waves or interrupted continuous waves given out by a vacuum-tube transmitter are superior for radio telegraphy. A preliminary description was given of a 200-watt and a 1,000-watt vacuum-tube transmitter for commercial radio telephony and telegraphy. Part II furnishes a detailed description of several component parts of these equipments, the complete assembled unit and similar information for a somewhat similar transmitter, to have an output of 2,000 watts.—*General Electric Review*, November, 1922.

Miscellaneous

Patent Laws of the World.—A convenient compilation of four pages which includes the names of the countries where patent protection is commercially available, the time for which such protection is granted in this country, the persons who may properly apply for patents, the time when such application can be made, renewal fees or taxes, if any, and the requirements for active or nominal working of the patent in order to retain exclusive rights.—*Bulletin No. 106 of Mida's Trade Mark and Patent Bureau.*

Departmental Organization.—LEE H. MANDEVILLE.—The author holds that the organization diagram is to the department force what the wiring diagram is to an engineer. It is the graphic representation of the manner in which the various parts of the organization are connected and how they should function with relation to one another. Every department head should draw up the diagram of his organization, and it should be posted where every member of the department may have an opportunity to see it whenever desired. Nothing will so clearly show whether or not a well-formed organization exists, where improvement could be made, what division of authority is made and how it is delegated.—*Paper before Association of Iron and Steel Electrical Engineers*, October, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Railway Signaling

By Everett Edgar King. New York: McGraw-Hill Book Company, Inc. 363 pages, illustrated.

A collection from various sources of common practice in the field of railway signaling presented in form suitable for the beginner. The sources from which the material has been drawn are of the best. No attempt is made in the book to compare the relative merits of different devices which are available for signaling and interlocking operations, but by careful selection and by citation of examples of applications the author furnishes to the reader a perspective of the subject.

To the electrical engineer interested in signaling only in a general way the book will furnish many interesting examples of electric circuit problem solutions. They show that the flexibility of electrical distribution and the reliability of such distribution and of the electrical devices required in this field have made modern railway signaling possible. The electrical engineer generally, as well as the budding signal engineer, ought to find the book useful and stimulating.

H. H. NORRIS.

Direct-Current Machinery

By Harold Pender. New York: John Wiley & Sons. 314 pages, illustrated.

Dr. Pender has written this textbook for students with the object of teaching the principles and performance of direct-current machinery without going into details of design. Many other attempts have been made to do this work, but the contribution of Dr. Pender has many meritorious features sometimes lacking. The outstanding feature of the book is the admirable treatment of commutation and armature reaction. In addition, the graphical construction used in depicting motor and generator characteristics is new and ingenious. Another departure is the incorporation in the text of an excellent chapter on the testing of machines. A good selection of problems and illustrations adds to the completeness of the text.

An objection to the book is the incorporation of the fundamental electrical and magnetic principles in tabloid form in the first chapter. In many ways this form is objectionable—it involves the swallowing of dry technical material by the student and shakes his interest in what follows. Moreover, since these fundamental principles underlie all that is to come, it would seem better to introduce them as they are needed and to elaborate them by applying them to the machines. In addition, one who reads the book feels that several machines have been treated in detail without correlating them in such a way as to leave outstanding the fundamental fact that a few principles only are introduced which upon proper application explain each and every machine phenomenon.

Despite these criticisms, the book should find favor as a text and should be useful to many electrical engineers whose work is connected with direct-current machinery.

L. W. W. MORROW.

Electric Transients

By C. E. Magnusson, A. Kalin and J. R. Tolmie. New York: McGraw-Hill Book Company, Inc. 190 pages, illustrated.

Transients have become practical in the electrical art, and the newer developments in transmission and design are accomplished by means of a more detailed knowledge of them. This textbook was written as an introductory treatise for undergraduate students in electrical engineering and is an admirable condensed presentation of the theory of transients. It presents very little new material and does not fully detail the derivation of formulas, but it does compile in condensed form the fundamental principles.

It discusses single energy transients and applies the principles to direct-current and alternating-current circuits. Double energy transients and the resulting traveling waves, surges and oscillations are discussed and applied to transmission lines. The subject of variable "constant" circuits is briefly treated, and "resonance" has one chapter devoted to its service.

A very good part of the book is its description of how to use oscillographs and methods for making, developing and interpreting oscillograms. Several problems which may be performed in the laboratory are stated, and many representative oscillograms are presented.

The book requires an adequate mathematical preparation and should be useful as a text and as a reference book to electrical engineers who wish to become familiar with the subject.

Standard Lighting with Incandescent Electric Lamps

Compiled by a staff of experts. New York: H. C. Cushing, Jr. 272 pages, 240 illustrations and diagrams, 55 tables.

This is the second edition, revised and enlarged, of this work, which has received the indorsement of the lighting department of the Joint Committee for Business Development, representing the National Electric Light Association and other electrical and associated bodies. The names of the authorities to whom credit is given by the compilers of the book are in themselves sufficient to show its character. They are: S. E. Doane, G. H. Stickney, D. W. Atwater, A.B. Oday, Ward Harrison, A. L. Powell, S. G. Hibben, H. A. Smith, R. E. Harrington, A. S. Turner, C. A. Atherton, M. Luckiesh, Earl A. Anderson, J. H. Kurlander, G. A. Clewell, H. H. Magdsick and J. R. Colville.

In the seventeen parts into which the book is divided will be found comprehensive information on illumination fundamentals and design data, on the lighting of stores, show windows, factories and workshops, offices, drafting rooms, schools, residences, churches, public buildings, hospitals and dental offices; on floodlighting, on lighting for outdoor and indoor sports, on the maintenance of interior lighting systems, on modern practice in street lighting, on electrical advertising, and on the code of lighting for factories, mills and other workplaces, prepared and issued by the Illuminating Engineering Society.

The volume is 6 in. x 9 in. in size and has a leatherette cover and gilt edges.

Die Elektricitaets-Lieferungs-Gesellschaft

By G. Siegel. Berlin: Privately printed by the Allgemeine Elektricitäts Gesellschaft.

This is a "Festschrift" of about 150 pages, with many photographs, tables and maps, giving a history of the development of some syndicated German electrical utilities for the last twenty-five years. The book should be of value to those interested in the economic as well as technical features of power and light properties. A copy is available in the Engineering Societies library.

V. KARAPETOFF.

Books Received

Electric Power Systems. By William T. Taylor. London: Sir Isaac Pitman & Sons, Ltd. 102 pages, illustrated.

High-Voltage Power Transformers. By William T. Taylor. London: Sir Isaac Pitman & Sons, Ltd. 113 pages, illustrated.

Handbook for Electrical Engineers. Second Edition, 1922. By Harold Pender. New York: John Wiley & Sons, Inc. 2,263 pages, illustrated.

Electric Power Plant Engineering. By J. Weingreen. New York: McGraw-Hill Book Company, Inc. 511 pages, illustrated. New edition.

Einführing in die Maxwellsche Theorie der Elektrizität und des Magnetismus. By Dr. Clemens Schaefer. Leipzig: B. G. Teubner. 170 pages, illustrated.

Die Elektrotechnik und die Elektromotorischen Antriebe. By Wilhelm Lehmann. Berlin: Julius Springer.

The Lead Storage Battery. By H. G. Brown. London: The Locomotive Publishing Company. 155 pages, illustrated.

Year Book of Wireless Telegraphy and Telephony. London: The Wireless Press, Ltd. 1,477 pages, illustrated.

Die Theorie Moderner Hochspannungsanlagen. By Dr. Ing. A. Buch. Munich and Berlin: R. Oldenbourg.

La Radiotéléphonie. By Carlo Toche. Paris: Gauthier-Villars et Cie. 98 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New Bill for Muscle Shoals

Representative Dickinson, a Former Ford Supporter, Has Measure for Federal Operation

A NEW bill dealing with the government's war-time nitrate and power projects at Muscle Shoals, Ala., has been introduced by Representative Dickinson of Iowa, the leader of the "farm bloc" in the House of Representatives. The bill is in many respects similar to the measure introduced in the Senate by Senator Norris of Nebraska, and like it would create a body to be known as the Federal Chemical Corporation. Mr. Dickinson's measure, which has been referred to the House committee on military affairs, has come like a bombshell to the camp of the Ford adherents in the House, inasmuch as its author, with the other members of the House "farm bloc," has been an out-and-out Ford man. Representative Dickinson, when introducing his bill, made public a statement which is said in Washington to mark the breaking up of the "farm bloc" interest in the Ford proposals for Muscle Shoals and to be in the nature of a final blow at these proposals. He is understood to have finally reached the decision that the Ford plan tends toward an indefensible monopoly by an individual. His statement in part follows:

PROPOSALS OF NEW BILL

"The proposed bill will conserve the $100,000,000 of government funds invested in a nitrate plant at Muscle Shoals for future war-time needs and during peace provide for the operation of such plant for the manufacturing of fertilizer without profit except a 4½ per cent interest charge on any additional funds necessary to complete and equip such plant.

"The placing of the Muscle Shoals plant in the hands of any individual tends to monopolize such production in the hands of the individual, besides putting under individual control immense water power of great value for manufacturing purposes. The Ford offer has been subjected to general criticism. Objection is made to giving to any individual the benefits of an investment of $105,000,000, obligating the government for $50,000,000, and placing this great property in a private corporation which would have the added advantages of price control of fertilizer production and would gain a manufacturing advantage in water rights, without supervision or control by any government agency.

"I am led to the conclusion that some plan of federal operation is the only solution that will insure early completion, the use of the plant during war for nitrate production and its operation during peace for the production of farm fertilizer at the lowest possible cost. It is, therefore, provided in the bill that a government-controlled corporation, known as the Federal Chemical Corporation, to consist of five members, three to be appointed by the President, the other two to consist of the Secretary of War and the Secretary of Agriculture, shall be given full power to complete and operate said plant for the manufacture of fertilizer at the lowest possible cost, for distribution among the farmers, with further power to sell the excess water power under the conditions, limitations and safeguards of the national water-power act now on the statute books."

By other provisions in the proposed law the chemical corporation is not to take control of the power from the government dams until these are completed and turned over to it by the Secretary of War. It shall negotiate with the Alabama Power Company for a settlement of the ownership of the Gorgas plant and may, subject to the approval of the President, sell the government's interest in this plant to the company. The three members of the corporation other than the Cabinet ministers are to have salaries of $10,000 each.

How California State Ownership Was Beaten

Owing to Wide Public Ownership of Stock and to an Intelligent and Informed Electorate, the Socialistic Venture Was Overwhelmingly Defeated

FINAL returns on the results of the election in California on the proposed water and power amendment to the state constitution show that one-quarter of the entire population of the state was represented in the vote and that the measure was defeated by a majority of more than 350,000. This is greater than the majority piled up by Senator Hiram Johnson or Governor Richardson, both of whom had clear fields, and greater than the vote cast on any other measure except one submitted to the voters at the election.

The campaign was unusual in character, and the heavy vote cast was clearly indicative of the widespread interest manifest in water-power matters in California. It set at naught the notion which the proponents of the measure sought to capitalize that the campaign was a fight between the power companies and the people. This propaganda the power companies were able to defeat quickly by showing that their fight was not different from that of the people and that, because of the wide ownership of stock by voters in California the fight was really a fight of the people against the politicians.

The power companies for that reason were not called upon to take up the cudgels. They simply invited the citizens of the state to read the provisions of the act and then visualize the conditions which would follow and compare them with the conditions that exist in California today. Attention was directed to the fact that California represented the white spot of prosperity in the United States, that it has suffered no slump as other sections of the country have, and that, while electricity has been difficult to obtain in other sections because of drought and shortage of fuel, the domestic, civic and industrial needs of California are not only amply provided for because of the foresight of the central-station companies, whose power houses are fully equipped to take care of present demands, but all future increases can be readily and efficiently accommodated.

The enormous majority registered against the measure was also taken as evidence that the people of California are in favor of private ownership and operation as opposed to inefficient and wasteful government ownership and operation and are content to rely on the assurances of excellent service at reasonable rates guaranteed to them under the regulatory laws of the state.

FEATURES OF THE CAMPAIGN

The most significant feature of the campaign was that it was not waged by the power companies themselves but by the 101,000 individual owners of public utility stocks residing in the state. Fortunately, when the campaign was at its height, news from Europe, particularly from Italy and France, acted as a boomerang against the advocates of the act for state ownership, because of the fact that in Italy and France, where government own-

ership of utilities has prevailed for many years, it had been finally discredited as inefficient and wasteful and as imposing too great a financial burden on the government. This news came at a time to be of greatest service to the opponents of the measure.

One of the surprises which the campaign revealed was that municipal ownership men themselves took the stump against the proposed constitutional amendment on the ground that it was detrimental to the best interests of California and repugnant to the safety and welfare of democratic institutions. In addition, civic organizations of all kinds, including real-estate boards, investment bankers, farm and fruit associations and more than 150 local leagues scattered in every city and town of the state, were up in arms against it on the ground that it bordered on a type of socialistic legislation that had injured North Dakota and brought terrible disaster in Russia.

These leagues made much of the fact that the amendment provided for the expenditure of $500,000,000 by a board of five, with authority to acquire without let or hindrance anything and everything necessary to the carrying out of the amendment. This was interpreted as meaning everything, because it was shown conclusively that the development of water power affects everything in California and that the prosperity of the state was absolutely dependent upon an orderly and economic development of its natural resources, which, with the exception of a fast-diminishing oil supply, are restricted entirely to water power.

Power Companies Realized Danger

Of course, the power companies of the state were the first to realize the danger which threatened them. The proponents of the measure claimed that their power scheme was patterned after that of the Hydro-Electric Power Commission of Ontario, but the power companies were able to show the shortcomings of the latter system through the study and report on it made by Messrs. Murray and Flood. When, in addition, it was brought home to the taxpayers of the state that state ownership would mean greater taxes—the state government of California is run entirely from taxes on public utility corporations—it no longer became a power company fight, but one of very vital interest to every house owner and farmer. Business interests were naturally opposed to the amendment because they feared it would strike at the very root of California's prosperity and stop the flow of capital so necessary to its upbuilding and future growth. Thus the great bulk of the responsible people of California were arrayed against the amendment for reasons other than those associated entirely with water-power development.

From what can be learned the election was not without its lesson to both sides in the controversy. The indications are that efforts will be made to present another but somewhat modified measure to the voters of California in 1924. By that time, however, industrial and power interests feel that sentiment will be stronger and more pronounced against the measure than it was at the recent election, because the more time people have to think over the matter and the more enlightenment they receive on it, the greater will be the opposition.

California State Ownership Campaign to Begin Anew

The state campaign committee for the water and power act of California has issued from its office in San Francisco an appeal for funds with which to continue its work for the passage of the measure, defeated overwhelmingly in the November elections. The committee claims that its successful opponents spent from $1,500,000 to $3,000,000 to defeat the measure, whereas the proponents of the measure expended $136,747.64, most of which was furnished by three or four men. "While these men are willing to bear their part in financing the 1924 campaign," says the circular letter, "they cannot undertake responsibility for so large a part as they carried this year."

To meet the situation, the California State Water and Power League is being organized. The membership will be divided into four groups—(1) contributing members, paying from 50 cents upward for the work each month; (2) paid-up members, contributing $25 in advance covering the two years of the campaign; (3) associate members, paying $5 a year, and (4) working members, who will make no pledge of financial support but will undertake to assist in getting the measure before the public.

Act Legalizing Loop Rates Sought in Wisconsin

As an outcome of the decision of the Wisconsin Supreme Court last June declaring that the municipality is the unit of rate determination and making illegal the "loop" system of establishing charges, the water-power interests of the state are, according to L. E. Gettle, chairman of the Wisconsin Railroad Commission. likely to make an attempt to have a bill passed by the 1923 Legislature making uniform rates legal for interconnected cities served from the same source of hydro-electric power, and thus obviating the necessity of varying rates in accordance with geographical proximity.

Mr. Gettle, who was the chairman of the committee on hydro-electric rates, read a report before the recent Detroit convention of the National Association of Railway and Utilities Commissioners favoring the "loop" plan of rate fixing. He says that the outcome of the Wisconsin decision is being awaited by public utilities and water-power experts in all parts of the country and points out that Utah, Washington and Tennessee, states with extensive developments of water power, have already put into effect rates determined on the "loop" system in direct contravention to the principle laid down by the Wisconsin Supreme Court.

S. E. D. Reviews Year's Work and Discusses Plans

At a meeting of the board of directors of the Society for Electrical Development held Saturday, Nov. 25, President Freeman said he believed that the purposes of the society were more clearly evidenced to the leading men of the industry than ever before and that the opportunity to promote the use of electricity through its various forms of service had been widely recognized. He told of discussion with the leading central-station men of the country, who had gone definitely on record as favoring the further development of the society. In this connection C. L. Edgar, president of the Edison Electric Illuminating Company of Boston and member of the society's executive committee, outlined a plan to insure financial support from all the larger companies.

The president then presented the general results of the program for cooperation with the Joint Committee for Business Development, saying that the relations between the two bodies were now thoroughly understood and that E. W. Lloyd, chairman of the former, had agreed with the officers of the society on definite plans by which the society would carry out work assigned to it. W. L. Goodwin, executive head of the society, said that about $50,000 would be needed for carrying out the immediate program agreed upon.

The work of the society since the last meeting was presented by diagrams showing that its activities now fall under seven broad heads: (1) Newspaper services, (2) trade-paper services, (3) map, cut and sales services, (4) special publications, (5) investigation of fires, (6) statistical services, (7) field work. Many of these services during the past year have been ordered and not merely sent to organized centers. For example, the editors of more than a hundred newspapers have definitely asked the society to furnish them regularly with the newspaper services. All the services are available for the use of any organization interested in the wider application of electricity, and their still wider use is limited only by the funds available. In the development of local electrical leagues the society is anxious to have all these services made useful as a basis for activities, and as far as possible it will put special men on local problems. Mr. Goodwin spoke of the organization of a division of home economics, already undertaken, and of a projected lecture service bureau.

Discussion developed with regard to expanding the board of directors to make it representative of specialized groups of manufacturers, particularly in the merchandising field, and President Freeman appointed F. M. Feiker, W. L. Goodwin and F. W. Bissell as a special committee on this subject.

Mechanical Engineers Discuss Problems

Annual Meeting in New York Has Many Features of Interest to Electrical Men—Animated Discussion on Power Equipment, Management, Test Procedure and Make-up of Codes

THE forty-third annual meeting of the American Society of Mechanical Engineers was held in New York on Dec. 4 to 7. With an attendance of more than 1,600, it was one of the most successful conventions in the history of the society. The outstanding feature was the animated discussion and interest in problems associated with the use of higher steam pressures and temperatures in power-plant work and in connection with the use of stokers and coal and ash-handling equipment for central-station plants. Another prominent feature of the convention was the notable address of the retiring president, Dexter S. Kimball, dean of the Engineering College of Cornell University, on the place of the engineer in modern industrial civilization. President Kimball has been preaching the gospel of social service and the possibilities of the engineer in the political field during the past year and has aroused a great deal of interest throughout the country on this subject.

Ash-Handling Methods

Ash handling was the subject of discussion at one entire session, the feature of which was a paper presented by John Hunter, chief engineer of the Union Electric Light & Power Company, St. Louis, and Alfred Cotton, chief of the research department of the Heine Boiler Company. The paper embraced a very extensive and complete discussion of the methods of removing ashes from basement boiler rooms, the design, construction and capacity of hopper ash pits, systems of mechanical conveyance and elevation, fluid and gas conveyance, and the final disposal of ash. Sufficient description and illustration of all successful methods of handling ash were given to enable those interested in the subject to lay out or criticise intelligently almost any installation with which they may be confronted.

Several engineers discussed the general problem of ash handling, attention being centered on (a) the logical fields for different types of ash-handling equipment, (b) the place and limitations of gas and fluid conveyors, (c) the size of ash pits and storage base, and (d) quenching of ashes.

Unless carefully designed and laid out, the steam-jet ash conveyor is very uneconomical in steam consumption, Eugene Hahn declared. The design of the nozzles is extremely important, and fittings, especially elbows, should be provided which will strongly resist abrasion and can be readily replaced.

The serious effect of small-size ash pits on stoker maintenance was emphasized by T. A. Marsh, who illustrated both good and faulty designs. He strongly advocated much larger ash pits than are ordinarily employed. Commenting on gas-type ash conveyors he contended that they are not suitable where considerable clinker has to be transported. Worn nozzles were pointed to as the chief cause of excessive maintenance in gas-type conveyors.

F. D. Allen maintained that most methods of quenching ashes are inadequate and advocated a system in which water headers run along the outside of the ash hoppers and connect with easily accessible spray nozzles that discharge water over the surface of the ashes. The principal advantages claimed for this system were the more uniform cooling of the ashes and the greater reliability and flexibility of operation. With tight-fitting hopper gates and drains for water discharged into the hoppers the basement floor can be kept dry, and a water seal can be maintained which will increase the economy of operation of the furnace. The speaker also referred to an installation at Durham, N. C., where carbon is being recovered from ash at a cost of 40 cents to 60 cents per ton.

More attention must be given to the working conditions under which boiler refuse has to be handled in designing ash-disposal systems, R. H. Beaumont said. Furthermore, the systems must be laid out in such a way that various means of removal from the plant can be utilized in emergencies.

Bottom-Dump Hoppers

Of all the systems considered by Mr. Hunter in his paper, N. E. Funk favored the bottom-dump ash hopper with railway or industrial cars for removing ashes. He maintained that this system is most easily operated and maintained, is flexible in operation and can be replaced by some emergency expedient when necessary. No more headroom is required than for other systems, he contended. Ample ash storage is imperative because emergencies will arise when the largest storage will be insufficient. Referring to water-sealed ash pits, he declared that they are somewhat untidy and are amenable to operation only with overhead cranes or grab buckets operated by a locomotive crane. The carrier-ring system of coal and ash handling is objectionable because it may discharge ashes into coal bunkers; the cross-bar conveyor, even when duplicate conveyors are employed, may shut down all the boilers in a row, and the vacuum ash tank is liable to blow up because of the generation of gas. In one 60,000-kw. plant using coal containing 15 per cent ash and operating at 70 per cent load factor it has been possible to handle all the ashes with two storage-battery locomotives, industrial cars and two men, Mr. Funk declared.

N. W. Elmer pointed out that disposal of ash will be a serious problem for all to consider if powdered fuel becomes more extensively used.

In congested sections it is becoming a very big problem how to dispose of ashes, I. E. Moultrop declared. In such places big ash pits are imperative Furthermore, the ash-handling equipment must be simple and should not break down easily. The ash hoppers should be high enough to permit railway cars, trucks or industrial cars to be run under them to remove the ashes. In emergencies the ashes can be dumped on this floor and removed later.

At Cleveland industrial cars and a skip hoist are employed to handle ashes, asserted T. Mainz. In emergencies the ashes are dumped on the floor. The speaker warned against cutting down the size of ash pits and storage space.

Explaining his reason for adopting submerged ash pits, G. G. Bell said that they prevent the emission of carbon monoxide, corrosive gases and flames and simplify the problem of ventilating the ash room. Furthermore, they cost only two-thirds what other ash pits would have cost. At the Windsor plant ten days' storage is provided in the submerged ash pits, the contents being removed by a crane, conveyor and aërial tramway. The aërial tramway which has recently been installed will take care of conditions for some years to come by filling in ravines around the station. Ashes can be handled with this tramway at a cost of 25 cents per ton, and this cost may be reduced to 12 to 15 cents.

In a written communication from E. H. Tenney it was pointed out that freezing of gates on overhead ash hoppers during cold weather can be prevented by steam lines.

In closing the discussion, Mr. Hunter pointed out that operating engineers are anxious to secure the largest ash pits possible, but monetary conditions sometimes stand in the way. He questioned the economy of recovering carbon from ash in most plants. Despite the comments on gas and fluid ash conveyors, he contended that they had a definite field and must have consideration for handling fine ash or dust. Submerged ash pits appeal to him, he declared, for the reasons previously outlined; besides, they provide considerable storage. In emergencies they can be unloaded by locomotive cranes if sufficient headroom is available. Referring to the disposal of ashes in powdered-fuel plants, he pointed out that John Anderson of Milwaukee has claimed that he has been able to remove 50 to 100 per cent of the ashes by washing the flue gases. He insisted that more consideration must be given to the problem of handling ashes in small plants.

Material-Handling Equipment

A report was submitted by the committee delegated to develop formulas for calculating the investment justified in material-handling equipment, the yearly cost of maintenance and the yearly profits. Mr. Hunt pointed out that the formulas are very simple to use but

cannot be presented without considerable explanation.

STOKER SYMPOSIUM AROUSES INTEREST

A profitable session was held under the direction of the fuels division, with Prof. L. T. Breckenridge in the chair. A symposium on stokers was presented in the shape of four phases, which outlined in detail the field, the operating possibilities, the installation methods and the development of the modern types of stokers. T. A. Marsh discussed the development and use of the modern chain-grate stoker and showed how greater boiler capacity can be obtained by increasing grate size or by increasing the draft. He gave in detail the operating possibilities of the modern chain-grate stoker for power purposes, including a table of results obtained by a number of stations equipped with these chain grates.

In discussing the overfeed-type stoker, G. I. Bouton stated that apparently this type has reached a limit in a stoker having a projected grate area of 100 sq.ft. to 110 sq.ft. in a single unit capable of burning sufficient coal under forced draft to develop about 2,000 boiler-horsepower at the maximum. Mr. Bouton discussed the development and present success in method of operation of the front and side-feed types of the inclined overfeed stoker, and gave illustrations of the settings. The effect of the content of ash in determining the fusion temperature was also discussed.

H. F. Lawrence labeled his paper "The Design and Operation of Underfeed Stokers" and described briefly the distinctive features of the single and multiple retort types of underfeed stokers, giving illustrations of a number of each type as well as particulars regarding their operation and results that have been obtained. The author accented the advisability of giving attention to the secondary feed system and pointed out the types of coal to which this type of stoker is best adapted. He also gave some very good curves and data showing the best types of fans to be used in stokers and a table of settings for the boilers.

The chronological history of stoker development to the present day was the subject of a paper by A. H. Blackburn.

These papers were discussed as a whole by many members, and much valuable information was obtained from those who have had experience with the several types. The consensus of opinion was to the effect that the chain-grate stoker was best adapted for burning high-ash Western coal. In connection with the operation of the chain-grate stokers, however, T. L. Mainz pointed out that among points to be watched is the amount of carbon in the ash and trouble with the seal at the end of the stoker. He said that the best results could be obtained by having a uniform size of coal sent to the grate and that this was a part of the function of the coal-handling system. Another point he mentioned was that the boiler-room dirt must be eliminated when using forced draft under the chain-grate stoker. Further discussion brought out the fact that several types of the modern stoker had solved these problems successfully.

H. C. Heaton of Sargent & Mundy pointed to results obtained by operating chain-grate stokers and said that one of the great features was to insure the proper spreading of the coal and that his experience indicated the movable spout as the most successful means of securing proper spreading.

In a general discussion W. N. Polakov brought out the fact that in many cases the installation of good types of stokers was in itself no guarantee of efficient operation. The human element must be considered and the personnel trained if good results are to be obtained. Mr. Roney also accented the necessity for a skilled personnel, and D. M. Meyers pointed out that, in engineering terms, a stoker's efficiency was the product of the mechanical efficiency by the human efficiency. He asked questions about the formation of clinkers on the underfeed type of stokers and the value of automatic control equipment and the ratio of combustion space to the capacity of a boiler, and also asked what possibilities there were of introducing stokers into marine practice.

Other speakers brought up the point that with modern conditions for obtaining coal it is a necessity to have a stoker that will operate under a wide variation of fuel conditions and, if at present there are seventy-five fuels and five stokers, the ideal thing would be to have one stoker that could burn any of the seventy-five fuels. Discussion brought out the fact that this ideal could not be reached at present, but that several types of stokers could burn a wide variety of fuels with success and efficiency. Another point brought up in this discussion was that the coal-handling equipment is a part of the stoker problem and that the furnace setting in particular is very important to insure proper upkeep of furnace refractory material and the arrangement of the material in the furnace. Devices for obtaining best operation for a given type of stoker and for getting rid of ash and clinker were discussed. O. P. Hood mentioned, incidentally, that a committee was at work to try to standardize engineering details in an anti-smoke ordinance.

QUESTION THE USE OF AUTOMATIC EQUIPMENT

One of the most interesting points in the discussion was regarding the necessity and advantage of using automatic stoker control equipment. The points brought out were to the effect that it was almost a necessity to afford the boiler-room employees proper training facilities, meters and instruments. Automatic equipment, it was pointed out, is a safeguard in regard to pressure maintenance. In many ways it is far from ideal, but much may be expected as it is developed. The parallel

The Engineer in Statecraft

Dean Kimball Hails His Advent in the Nation's Councils—The Business and the Scientific Types

IN HIS presidential address before the New York City convention of the American Society of Mechanical Engineers last Monday Dexter S. Kimball, dean of engineering at Cornell, dwelt on the increasing disposition of the engineer to play his part in public life, instancing Herbert Hoover and Governor Hartness of Vermont as conspicuous examples of this new tendency. After alluding to the military type and the legal type of political leadership, the first of which had passed in modern democracies and the second of which inevitably harked back to precedent rather than kept pace with change, Dean Kimball said:

"There remain for consideration two other types of mind from which a new industrial leadership may come, namely, the business or financial type and the scientific type. The business type of mind with the aid and counsel of the legal and engineering fraternities has built up modern industry as we now see it. There can be little doubt as to the ability of this type of mind to plan and direct the larger aspects of industry along existing lines. One weakness lies in its apparent inability to appreciate or rather to acknowledge that a new industrial day has dawned in which industry is being viewed more and more as the support of human life and not as a means of producing private, corporate or state profits. If the new industrial leadership comes, therefore, from the business world, the business type of mind, I believe, will have to be greatly modified."

TWO TYPES OF SCIENTIFIC MINDS

Dean Kimball then pointed out that future hope rested upon the scientific type of mind. There are two types, he said, one visionary, unpractical, blazing the way for the world by always seeking out new truths "in science, philosophy, religion and what not." The engineering mind, he said, belongs to the other type. That type is interested in applied science and is always practical.

"No one would presume to say that the engineer alone can solve the industrial riddle, but it is clear that he can make a very great contribution to the solution," he added. "But it becomes increasingly clear that hope of a solution rests with the two groups just discussed. Whether the new leadership comes from one field or the other, or from a combination of the two, the problem of universal well-being offers a challenge and a call to duty that the engineer may not refuse. There is good reason to believe he will do his share of work in attaining the ultimate results desired. Already there are significant signs that he has accepted this duty."

operation of boilers and fans with control based only on steam pressure was mentioned as decidedly a makeshift proposition at the present time, but several members maintained that by using a certain number of the boilers to maintain pressure with manual control of firing maintenance on the remainder of the boilers a good combination for obtaining reliable and efficient operation would be gained.

Industrial Education and Training

One session of the meeting was devoted to the education and training of men for the industries. This was taken up from the standpoint of the correspondence school, extension course and apprentice course in industries, and very valuable material along these lines was compiled and presented by a committee. The statistical information afforded an indication of the great increase in training men for the industries.

Baffling the Boilers

Results of extensive tests on large type W Stirling boilers at Detroit to determine the effects of different baffle arrangements, grades of coal, banking methods, intervals between blowing of flues and methods of operating during low-load periods were presented by P. W. Thompson. As a result of these tests the boilers have been rebaffled with considerable improvement in efficiency and degree of superheat, and the Babcock & Wilcox Company has developed a new design of this type of boiler. The baffling arrangement selected exposed two layers of tubes to the radiant heat of the furnace and allowed the gases to cross the inner bank of tubes at the top, pass the superheaters and then return along the outer bank of tubes to the stack. With this arrangement an average increase of 50 deg. F. in superheat was obtained, the flue-gas temperature was reduced 70 deg. and the draft was reduced 38 per cent.

Changes of the extension grates did not have the desired effect, although it is believed that further study will develop better arrangements of air openings and possibly reduce ash-pit losses. Air leakage from the chamber below the stokers was found to be as much as 25 per cent at high ratings. As much as 2.6 per cent increase in efficiency was obtained with the best coal tested, but clinker trouble was experienced, so that one of the grades giving only 0.6 per cent increase in efficiency was preferable. Energy for boiler auxiliaries averaged between 0.7 and 1.6 per cent for light load and 170 to 200 per cent rating. Considering all economic factors, twelve and a half hours was determined as the most desirable interval between blowing of flues. The coal required for banking in excess of four hours was found to be $8,600 + 105 \times$ hours for floating bank and $8,000 + 280 \times$ hours for dead bank. A study of heat absorbed indicated that five rows of tubes between the upper center drum and each mud drum and ten rows of tubes in the outer banks are more desirable than are the present arrangements.

In the discussion of this paper great commendation was expressed concerning the accuracy and value of the investigation. The expense of such tests, while great, is well justified by the higher efficiency and superheat obtained, declared Dr. Jacobus.

Determination of Pipe Bends

As a result of mathematical study and tests, Sabin Crocker and Sterling S. Sanford presented charts which can be used in selecting the proper size and shape of bends to care for a given expansion and in determining the force exerted by a bend in state of deflection. In general the authors recommend bends of larger dimensions than ordinarily used. Their figures are said to be on the side of safety. In some cases the bends tested showed greater flexibility than was anticipated.

While the contribution of Crocker and Sanford was commended, attention was directed by at least two speakers to apparent oversights that make the calculated results differ from test results. The advisability of considering expansion loops made of straight pipes was suggested by a few speakers. Some questions were raised regarding the effect of pressure and temperature on the flexibility and stress in pipe bends.

W. B. Campbell contended that even some of the conclusions from actual tests are not accurate because they are based on ideal conditions.

This contention was carried still farther by Robert Crane, who said that the assumption that the neutral fiber runs through the center of the pipe bend does not result in accurate conclusions. Furthermore, he contended that the fact that some of the calculated results were greatly different from test results should be sufficient reason for thoroughly investigating the cause.

More attention must be given to flexibility of and stress in pipe bends, asserted F. Hodgkinson. Flexibility can often be obtained with loops composed of straight pipes instead of fancy bends. to permit alignment of pipes more consideration must be given to torsional flexibility and means for allowing it.

J. V. Brady related some trouble with bends which had not been properly annealed. They tended to straighten after being placed in service. He also advocated more consideration of straight-pipe loops, saying that no excessive pressure drops had been experienced with an extensive installation of such expansion loops at Hell Gate.

Mr. Whitney called attention to some U bends which did not allow the deflection calculated, whereas double-U bends allowed more than twice the deflection. He contended that designers need not fear ripples or buckling on the inside of pipe bends since they reduce stress in outside fibers and increase flexibility. Seamless tubing was urged for bends requiring large-diameter pipe, because with its use there is not the danger of rupturing the outside of the bends.

John Stevens referred to installations in which flanges had failed without the bends showing signs of weakness. In Europe, he pointed out, reservoirs are being extensively installed between the steam mains and the turbines. Duplication of such practice was recommended in this country.

George Orrok raised a question regarding the effect of operating steam pressures and temperatures on the fiber stress and deformation in pipe bends.

Feed Heating for High Thermal Efficiency

The problem of determining the correct feed-water temperature for high thermal efficiency was presented by Linn Helander. He considered a 25,000-kw. station, investigating the conditions when using single-stage and multiple-stage condensate heaters, both with and without economizers and treating the subject from the viewpoint of thermal efficiency only. For power plants using single and multiple stage heaters of the condenser type, the temperature of the boiler-feed water as it leaves the heater should not be less than 150 deg. F. when using economizers and not more than 260 deg. F. when not using economizers. Heat balances showed that when using single-stage heating and no economizers better results were obtained from heating the feed water by combining steam from the house turbine and that bled from the main unit than when using the steam from a house turbine alone. Double-stage heating with no economizers also showed better thermal efficiencies when using a larger amount of steam from the main unit than from the house turbine.

The increasing tendency to bleed the main units for heating the feed water with the consequent decrease in use of house turbines was the keynote of the discussion. W. M. Keenan said that in the new Brooklyn Edison plant the heaters will be supplied with steam by bleeding the main turbines. He pointed out that for a single stage the best bleeding point is between 20 lb. and 30 lb. absolute pressure. For two stages the best points are 12 lb. and 100 lb. absolute pressure, respectively.

Commenting on modern practice as to the use of house turbines, Prof. A. G. Christie said that in the future large stations will use one or possibly two of these turbines, the main supply of steam for heaters being taken from the main turbines. O. F. Junggren and F. Hodgkinson both expressed the same opinion basing their remarks on the fact that much better over-all efficiency can be obtained by bleeding the main units. Ideal operating conditions, according to Mr. Junggren, depend on producing the maximum power in the turbine and heating the feed water to the limit by bleeding. Mr. Hodgkinson pointed out that turbines of modern design are now provided with four bleeding points, namely, 140 deg. F., 200 deg. F., 50 lb. and 120 lb. absolute pressure.

Higher Pressures and Temperatures

Higher steam pressures and temperatures were the subject of considerable

discussion. Two papers on the subject were presented—one by George A. Orrok and W. S. Morrison (published in considerable detail in the Dec. 2 issue of the *Electrical World*); the other by B. N. Broido. In the latter paper were given results of tests to determine the heat-transmission coefficients of bare and covered pipes at different steam velocities, superheats and pressures. Suggestions were made regarding velocities to select for best economy of transmission.

The discussion from the floor went into practically every phase of this subject—early attempts at high pressure operation, the question of whether higher pressures and temperatures are the way to greater economy, need of balancing fixed charges against fuel cost, possible effect on continuity of operation, effect of prolonged high temperature on metals, value of alloys for fittings, serious problems with pipe flanges, experiences with high pressures and temperatures in the oil distillery field, need of standardizing pipe fittings, economy of regenerative cycles or superheating between stages, higher pressures versus refinement in operation and the use factor of turbines. Every one agreed that reliability and continuity of operation are paramount and that efficiency, flexibility of operation and simplicity rank about on a par in consideration of any new design.

O. F. Junggren contended that past experience has not indicated so far that we have reached the economic limit of pressure, and that engineering ingenuity can be expected to solve all problems.

H. D. Hibbard emphasized the necessity of investigating the effect of continued high temperatures on the elastic limit and tensile strength of metals. Gun steel, he declared, reaches its maximum tensile strength at 950 deg.—about 300 deg. above steel used in power plants.

Dr. D. S. Jacobus pointed out that the problem in using higher pressures and temperatures is more with pipe fittings and flanges than anything else, owing to the falling off in elastic limit. Flanges must not spring or distort and hence they cannot have an extreme overhang.

Referring to experience in the oil-distillery field with high pressures and temperatures, Mr. Millikan declared that valves have been in successful operation at pressures and temperatures up to 1,200 lb. and 1,000 deg. superheat respectively. The chief requirement in such valves is that they shall be made of acid open-hearth steel, be symmetrical and have no flat surfaces and be carefully annealed.

W. J. Wohlenberg contended that there is no need of economizers if the regenerative cycle is used. Mr. Orrok maintained that the more times steam is taken from an expansion stage and returned to the input side the higher the economy will be.

Several speakers, notably I. E. Moultrop, contended that before going to higher pressures and temperatures more attention should be given to refinements in operation. John Stevens presented curves which indicated the effect of coal cost and load factor on efficiency and first cost, while Peter Junkersfeld called attention to the use factor of a number of turbine installations running from twenty to thirty hours per year up to six thousand to seven thousand hours per year. He pointed out that whereas the use factor of one-year-old turbines may be only 44 to 58 per cent, it drops off rapidly as the turbines get older, owing to the economy of using a more modern turbine.

On Wednesday night the American Society of Mechanical Engineers held a joint meeting with the American Economic Association. E. M. Herr, president Westinghouse Electric & Manufacturing Company, and Prof. W. C. Mitchell of Columbia University were the principal speakers.

Kentucky Association of Public Utilities

Assembling at the Phoenix Hotel and the University of Kentucky, Lexington, Ky., on Tuesday, Dec. 12, for its annual meeting, the Kentucky Association of Public Utilities will listen to an excellent program of addresses by prominent representatives of utilities and other industries.

National N. E. L. A. Committees Meet

Public Policy, Customer Ownership, Water-Power Development, Business Promotion and Executive Activities Bring More than a Hundred Leading Executives to Headquarters

MORE than one hundred leading executives of the electric light and power companies of the country attended a series of meetings of the principal committees of the National Electric Light Association in New York City on Dec. 4, 5 and 6. These were the meetings of the public policy committee, the national executive committee, the Public Relations National Section executive committee, the customer ownership committee, the water-power development committee and the Joint Committee for Business Development.

At the public policy committee meeting all matters pertaining to public relations and the general policy of the industry were discussed and recommendations thereon made to the national executive committee.

A report covering the activities of the Public Relations National Section was made by Chairman H. T. Sands and all of these activities were approved by the public policy committee. Mr. Sands reported that the executive committee of his section recommended the continuation of the association's good-will advertising program during 1923. After discussion the recommendation was approved by the public policy committee, which agreed to underwrite the amount necessary to carry on the program.

Chairman John W. Lieb of the joint fuel committee reported that through representation in Washington the National Utilities Association had been able to assist public utilities in all parts of the country in continuing operation of their plants during the recent coal shortage and that this activity was continuing through the present crisis. He reported that the fact-finding commission appointed by President Harding to investigate the coal industry has requested the joint fuel committee to make a report to that commission regarding the utility situation.

The public policy committee appointed a sub-committee consisting of the chairman (Martin J. Insull), S. Z. Mitchell and R. H. Ballard to pass upon the statement of approval of the customer-ownership program which is to be prepared by the customer ownership committee. This will include a plan for policing the securities issues of the industry in order to safeguard the public against fraudulent or valueless issues.

Announcement was made that the radio committee had appointed a sub-committee to take up details of important technical and commercial questions with respect to carrier current and that a report from this sub-committee may be expected at the next meeting.

Customer Ownership Alive

Great Interest Being Manifested by the General Public in Utility Securities

SALES of electric light and power company securities to customers and the public at large will be in excess of $175,000,000 during 1922 and are expected to reach a total of $250,000,000 during 1923, according to reports and estimates received by the customer-ownership committee of the N. E. L. A. during a meeting at national headquarters on Dec. 4 and 5. Almost all the members of the committee were present, and each reported the amount of sales of preferred and common stock issued by his company and by companies in the same district of which he had knowledge. The aggregate was $114,000,000. In addition, it was reported that one of the leading bond houses estimated that bond issues for 1922 would exceed $550,000,000, bringing the total amount of securities issued and sold during 1922 up to approximately $725,000,000, with a probability that the total is many million dollars in excess of this amount.

Every effort will be made by the committee representing the N. E. L. A. and working in conjunction with committees from the Investment Bankers' Association and the National Association of Railway and Utilities Commissioners to police the issuance of securi-

ties by electric light and power companies in an effort to protect the public from possible activity by unscrupulous persons or corporations seeking to take advantage of the increased favor electric light and power securities are enjoying in the investment field.

Both the national executive committee and the public policy committee have indorsed the movement and the plan outlined by the customer-ownership committee for its furtherance.

Joint Committee Is Busy

Formation of Local Committees and Provisions Made for Additional Literature

FORMATION of local committees to act as clearing houses for the electrical industry in each of 749 cities and towns where the Joint Committee for Business Development is now represented was planned at a meeting of the committee held in New York City on Dec. 5. It was decided to send letters to representatives of the committee throughout the country, requesting them to form committees of three or more members in their communities to put into action the plans of the business development movement and to furnish information regarding local conditions in the electrical industry. These committees will act as clearing houses for both national and local matters, handling statistical data, furnishing information and making recommendations.

It was announced that 1,100 questionnaires sent out by the Electrical Supply Jobbers' Association and the Association of Electragists International have been returned, and the information is now being compiled at headquarters.

Wiring came in for much attention at the session. Authority was given for the issuance of a pamphlet on wiring, discussing methods for local campaigns and calling to the attention of local electrical interests the importance of high standards of wiring and the necessity of more convenience outlets.

It was reported that the Georgia Electrical Association at its meeting on Nov. 29 had devoted much time to a wiring conference and that the Georgia Railway & Light Company and the Alabama Power Company plan to call meetings of commercial men in Atlanta and Birmingham to discuss wiring programs for the communities in which they operate.

The committee was informed that P. B. Zimmermann, chairman of the electrical lighting department, was preparing a prospectus on home lighting and another on commercial lighting. Chapters on industrial heating are being prepared by C. K. Nichols, chairman of the industrial heating and melting department. A prospectus on industrial cooking is being compiled by C. E. Greenwood, chairman of the domestic and industrial appliance department.

L. L. Holding of the Public Service Company of New Jersey and Charles R. Skinner of the New York Edison Company were made members of the committee, the former becoming chairman of the power department and the latter chairman of the electrical transportation department.

Progress on Many Lines

Executive Committee Hears Good Reports on Inductive Co-ordination and Other Work in Hand

COMPLETION of a set of rules of practice and procedure in line with the joint agreement on principles of inductive co-ordination between the American Telephone & Telegraph Company and the N. E. L. A. was announced by R. F. Pack, fourth vice-president of the N. E. L. A. and a member of the engineering sub-committee on inductive co-ordination, at a meeting of the national executive committee of the N. E. L. A. at headquarters on Dec. 6. It is believed that this will result in facilitating the development of both industries as it will remove one of the great causes of delay in construction and extension work in many parts of the country.

The attendance at the executive committee meeting was the largest this year, representatives being present from every section of the country and from all divisions.

Chairman H. K. Mohr of the membership committee reported a net increase of seventeen members since June 30.

A report upon national activities was made by Executive Manager Aylesworth, who requested those present to urge upon officers of the several divisions they represent the desirability of those divisions fixing the dates of their conventions so that they will not in any way conflict with the national convention. He also urged that every effort be made to have the several state commissions adopt the amended classification of accounts which was adopted by the National Association of Railway and Utilities Commissioners.

A symposium of conditions throughout this country and Canada was presented by the representatives of the several divisions. All reports indicated a very healthy growth in the electric light and power industry, and particularly a growing understanding between utilities and the public, with resultant better public relations and easier financing conditions, which in turn mean more rapid development of electric light and power facilities.

An interesting outline of the California water and power act campaign was presented by Past-president R. H. Ballard, who gave entire credit for the defeat of this act to the citizens' committee and the hundred thousand security holders of the electric light and power companies in California.

Reports showing progress were presented by the chairman of the four national sections. Each outlined in a general way the subjects to be covered in the reports at the national convention in New York in June.

Chairman Hogue of the Commercial Section announced that, in co-operation with manufacturers of electric vehicles, a school for salesmen of electric vehicles will be opened within the next few weeks.

The committee approved the national advertising recommendations of the Public Relations National Section and the public policy committee and appropriated sufficient money to carry on the program during 1923.

Announcement was made by H. P. Liversidge, representing Chairman R. F. Schuchardt of the Technical National Section, that a revision of the "Meterman's Handbook" has been completed, and the executive committee authorized the publication of this handbook, which will be ready early next year.

A résumé of the work of the Joint Committee for Business Development was given by Chairman E. W. Lloyd, and the executive committee approved of the work already done and of plans now completed to give further impetus to the movement.

With the approval of the executive committee, President Smith appointed John W. Lieb as N. E. L. A. representative in the United States Chamber of Commerce delegation to the second general conference of the International Chamber of Commerce in Rome, Italy, March 19 to 26, 1923.

Public Relations Prosper

N. E. L. A. Committee Reports Additional Bureaus of Information and Model Laws

CONTINUATION of the National Electric Light Association's national good-will advertising program during the year 1923 was recommended by the executive committee of its Public Relations National Section at its meeting at national headquarters on Monday, Dec. 4. The recommendation to the national executive committee was that not less than $75,000 should be appropriated and that the importance of customer ownership, the value of the service and the tremendous development now being carried on be stressed in the advertising copy. The meeting was regarded by Chairman H. T. Sands as perhaps the most important meeting of the section's executive committee during the present administrative year. It was exceptionally well attended.

The Information Bureau organization committee reported that two additional committees will be organized and in operation within the next month or six weeks, one for Pennsylvania and the other for Louisiana and Mississippi, with headquarters at New Orleans. John A. Britton, speaking on behalf of the California delegation present, voiced the belief that California is in need of a bureau on public utility information and that one would be organized within the next few months.

In commenting upon the work of the women's committee, Franklin T. Griffith of the Portland (Ore.) Railway, Light & Power Company spoke of the

interest that has been aroused by women employees in the activities of the Portland company and in the many domestic applications of electricity. Many women have joined the thirty-two women's organizations in Portland and the surrounding territory, so that whenever a discussion of electricity or the electric light and power company comes up at any of the meetings these women are prepared to refute misstatements.

Chairman P. L. Thomson of the manufacturers' advertising committee stated that his company—the Western Electric Company—is to continue its good-will program and expressed the belief that other manufacturing companies will continue to participate if the N. E. L. A. decides to continue its part in the program.

John C. Parker of the Brooklyn Edison Company, chairman of the committee on co-operation with educational institutions, suggested an annual meeting of from three to five days during the summer vacation or during the Christmas recess which would be attended by college professors, at which time brief but complete information in the form of lectures touching upon all phases of the electric light and power business would be given.

M. S. Sloan of the Brooklyn Edison Company outlined the educational work being done by his company in co-operation with the faculty and students of the Brooklyn Polytechnic Institute. A model law legalizing the investment of savings banks and trust funds in electric light and power utilities securities will be introduced in the New York State Legislature at the request of the State Savings Bank Association. According to Mr. Sloan, who is chairman of the committee on relations with financial institutions, there is $3,000,000,000 on deposit in New York savings banks and the savings banks themselves are eager for a wider field for the investment of surplus funds which at present are lying idle.

Speaking for W. W. Freeman, chairman of the committee on uniformity of state regulatory laws, Executive Manager Aylesworth reported that the draft of the model law is virtually completed.

Chairman Sands announced that the next meeting of the executive committee of the association would be held in Chicago in March, 1923.

Charles A. Coffin Foundation Is Set Up

General Electric Company Creates Fund of $400,000 in Honor of Its Founder, to Provide Rewards for Its Employees and for Utility Companies and Aid for Education and Research

UNDER date of Dec. 2, the president of the General Electric Company issued the following letter in explanation of the Charles A. Coffin Foundation, just established by the directors of the company:

"On May 16, 1922, Charles A. Coffin, in his seventy-eighth year, retired from the active leadership of the General Electric Company. Mr. Coffin has been identified with the development of the electrical industry since 1882. He was the founder and creator of the General Electric Company, of which he has been the inspiration and leader for thirty years. As an expression of appreciation of Mr. Coffin's great work not only for the General Electric Company but also for the entire electrical industry, and with the desire to make this appreciation enduring and constructive, as Mr. Coffin's life and work have been, the board of directors of the General Electric Company created on his retirement and now desire to announce 'the Charles A. Coffin Foundation.'

"GERARD SWOPE, President."

The following account of the objects of the fund and the methods that will be followed in its administration was given out by the company:

"By action of its board of directors, the General Electric Company has set aside a fund of $400,000, to be known as the 'Charles A. Coffin Foundation,' the income from which, amounting to approximately $20,000 per year, will be available for encouraging and rewarding service in the electrical field by the award of prizes to the company's employees and by giving recognition to lighting, power and railway companies for improvement in service to the public, fellowships to graduate students and funds for research work at technical schools and colleges.

"The foundation will be controlled and administered by a foundation committee appointed by the board. This committee, within the limits of the purposes for which the foundation is created, will have power to change the conditions applicable to the distribution of the fund and the amounts for each particular purpose.

HOW THE INCOME WILL BE USED

"The committee proposes to distribute the income of the foundation as follows:

"First—Eleven thousand dollars in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art. Particularly, the prizes are further to encourage suggestions from workmen. With each prize the company will give a certificate of award. Foremen's prizes are to be awarded for the best department, taking into account its appearance, efficiency of operation and conditions which add to the better conduct of the work and the welfare of the employees. All employees of the company, except executive officers, heads of departments, works managers, superintendents, district office managers and similar executives are eligible for such prizes. In works where employees' representation has been adopted such representatives will co-operate with the prize committee in awarding prizes.

REWARDS TO UTILITY COMPANIES

"Second—A gold medal, to be known as the Charles A. Coffin medal, will be awarded annually to the public utility operating company within the United States which during the year has made the greatest contribution toward increasing the advantages of the use of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive $1,000 for its employees' benefit or similar fund. A committee to be named by the National Electric Light Association and known as the Charles A. Coffin prize committee of the National Electric Light Association, which shall consist of its president, the chairman of its public policy committee and a third member nominated by them, will award this medal, acting with the advice and co-operation of a committee appointed by the foundation committee. The expenses of the committee are to be paid out of the income of the foundation.

"Third—A gold medal, to be known as the Charles A. Coffin medal, will be awarded annually to the electric railway company within the United States which during the year has made the greatest contribution toward increasing the advantages of electric transportation for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive $1,000 for its employees' benefit or similar fund.

"A committee to be named by the American Electric Railway Association and known as the Charles A. Coffin prize committee of the American Electric Railway Association, which shall consist of its president, the chairman of the committee on policy and a third member nominated by them, will award this medal, acting with the advice and co-operation of a committee appointed by the foundation committee. The expenses of the committee are to be paid out of the income of the foundation.

"Fourth—Five thousand dollars is to be awarded annually for fellowships to graduates of American colleges and technical schools who, by the character of their work and on the recommendation of the faculty of the institution where they have studied, could with advantage continue their research work either here or abroad; or some portion or all of the fund may be used to further the research work at any of the colleges or technical schools in the United States. The fields in which these fellowships and funds for research work are to be awarded are electricity, physics and physical chemistry. A committee appointed by the foundation committee will award such fellowships and funds for research work, with the advice and co-operation of a committee of three, one to be appointed by each of the following: National Academy

of Sciences, American Institute of Electrical Engineers and Society for the Promotion of Engineering Education. This committee is to be known as the Charles A. Coffin fellowship and research fund committee, and the fellowships are to be known as the Charles A. Coffin fellowships. The expenses of the committee are to paid out of the income of the foundation.

"Fifth—In each annual report of the General Electric Company a statement will be made of the awards under the Charles A. Coffin Foundation, and other publicity will be given to such awards.

FORMATION OF COMMITTEES

"The Board of Directors of the General Electric Company has appointed as the Charles A. Coffin foundation committee the following officers of the company: A. W. Burchard, J. R. Lovejoy, E. W. Rice, Jr., Gerard Swope and O. D. Young.

"The advisory committee of the General Electric Company will administer the fund within the organization of the General Electric Company. The following committees to administer the fund and to act with organizations outside the company have been appointed:

"Committee to co-operate with the National Electric Light Association—A. H. Jackson, vice-president; J. R. Lovejoy, vice-president.

"Committee to co-operate with the American Electric Railway Association—J. G. Barry, vice-president; A. H. Jackson, vice-president.

"Committee to co-operate with the National Academy of Sciences, American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education—E. W. Rice, Jr., honorary chairman; A. H. Jackson, vice-president; W. R. Whitney, director of research laboratory."

Hoover Urges Quick Action on Colorado Pact

THE ratification of the Colorado River pact signed at the conclusion of a hearing before the Colorado River Commission at Sante Fé, N. M., on Nov. 24 was urged by Secretary Hoover, chairman of the commission, in a statement issued at Los Angeles last week.

"The foundation has been laid for a great American conquest," declared Mr. Hoover. "The harnessing of the giant Colorado River will follow the ratification of the pact by the seven states of the Colorado River basin. Then the Southwest will come into its magnificent heritage of power and life-giving water, and all the nation will be vastly benefited. The first step is to settle the controversy between the upper and the lower districts of the Colorado basin. There can be no development until this is settled. Ratification by the states of the pact agreed upon by the Colorado River Commission will speedily accomplish this. If the matter is forced upon the Supreme Court, it may require years. The next step will be the construction of a control dam in the lower reaches of the river. The commission adopted a resolution urging Congress to proceed toward the immediate construction of the control works."

While the commission made no recommendation concerning the site of the dam, Mr. Hoover said he favored its construction at or near Boulder Canyon. He was emphatic in stating that there was no need to quarrel over the division of the water and said that the big thing about the compact is that it breaks the blockade on development of the whole river.

Colorado River Treaty a Simple Document

Total of 7,700,000 Acre-Feet a Year Apportioned to Each of the Two Basins, with Right of Increase by 1,000,000 Acre-Feet a Year to Lower Basin

THE full text of the compact accepted by the Colorado River Commissioners at their Santa Fé meeting, the successful result of whose deliberations was reported in the *Electrical World* for Nov. 25, comprises only eleven articles and is free from technical or legal verbiage. As indicated last week, it divides the territory watered by the Colorado and its tributaries into two basins. The upper basin includes the territory drained by the Colorado above Lee Ferry and the lower basin the territory drained by the Colorado below Lee Ferry, Lee Ferry being a point one mile below the mouth of the Paris River. Colorado's and Wyoming's interests thus lie in the upper basin, California's and Nevada's in the lower basin, and Arizona's, New Mexico's and Utah's in both. The total amount of water apportioned to each basin is 7,700,000 acre-feet per annum, with the right of increase of use by 1,000,000 acre-feet accorded to the lower basin. Navigation is subordinated to use for domestic, agricultural and power purposes, and power is subordinated to domestic and agricultural purposes. The upper basin is not to take more than 75,000,000 acre-feet in any consecutive period of ten years. If Mexican rights to Colorado River water shall be later recognized by the United States and cannot be supplied from the surplus flow, then the two basins shall share equally in making up the deficiency.

THE TREATY IN FULL

The treaty now awaits ratification by Congress and the seven states concerned. Its provisions follow in full:

"The States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming have resolved to enter into a compact under the act of the Congress of the United States of America approved Aug. 19, 1921 (42 Statutes at Large, page 171), and the acts of the legislatures of the said states, and have through their governors appointed as their commissioners S. W. Norviel for the State of Arizona, W. F. McClure for the State of California, Delph E. Carpenter for the State of Colorado, J. G. Scrugham for the State of Nevada, Stephen B. Davis, Jr., for the State of New Mexico, R. E. Caldwell for the State of Utah, Frank C. Emerson for the State of Wyoming, who after negotiations participated in by Herbert Hoover, appointed by the President as the representative of the United States of America, have agreed upon the following articles:

"Article I. The major purposes of this compact are to provide for equitable division and apportionment of the use of the waters of the Colorado River system, to establish the relative importance of different beneficial uses of water, to promote interstate comity, to remove causes of present and future controversies, and to secure the expeditious agricultural and industrial development of the Colorado River Basin, the storage of its waters and the protection of life and property from floods. To these ends the Colorado River basin is divided into two basins, and an apportionment of the use of part of the water of the Colorado River system is made to each of them with the provision that further equitable apportionments may be made.

DEFINITION OF TERMS

"Article II. As used in this compact: (A) The term 'Colorado River system' means that portion of the Colorado River and its tributaries within the United States of America. (B) The term 'Colorado River basin' means all of the drainage area of the Colorado River system and all other territory within the United States of America to which the waters of the Colorado River system shall be beneficially applied. (C) The term 'states of the upper division' means the States of Colorado, New Mexico, Utah and Wyoming. (D) The term 'states of the lower division' means the States of Arizona, California and Nevada. (E) Tbe term 'Lee Ferry' means a point in the main stream of the Colorado River one mile below the mouth of the Paris River. (F) The term 'upper basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry and also all parts of said states located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry. (G) The term 'lower basin' means those parts of the States of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River system

below Lee Ferry and also all parts of said states located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry. (H) The term 'domestic use' shall include the use of water for household stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

APPORTIONMENT OF WATER

"Article III. (A) There is hereby apportioned from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, for exclusive beneficial consumptive use, 7,700,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist. (B) In addition to the apportionment in paragraph (A) the lower basin is hereby given the right to increase its beneficial consumptive use of such waters by 1,000,000 acre-feet per annum. (C) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (A) and (B), and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the states of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (D). (D) The states of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact. (E) The states of the upper division shall not withhold water and the states of the lower division shall not require the delivery of water which cannot reasonably be applied to domestic and agricultural uses. (F) Further equitable apportionment of the beneficial uses of the waters of the Colorado River system unapportioned by paragraphs (A), (B) and (C) may be made in the manner provided in paragraph (G) at any time after Oct. 1, 1963, if and when either basin shall have reached its total beneficial consumptive use as set out in paragraphs (A) and (B). (G) In the event of a desire for a further apportionment as provided in paragraph (F), any two signatory states, acting through their governors, may give joint notice of such desire to the governors of the other signatory states and to the President of the United States of America, and it shall be the duty of the governors of the signatory states and of the President of the United States of America to forthwith appoint representatives whose duty it shall be to divide and apportion equitably between the upper basin and lower basin the beneficial use of the unapportioned water of the Colorado River system as mentioned in paragraph (F) subject to the legislative ratification of the signatory states and the Congress of the United States of America.

"Article IV. (A) Inasmuch as the Colorado River has ceased to be navigable for commerce and reservation of its waters for navigation would seriously limit the developments of its basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding. (B) Subject to the provisions of this compact, water of the Colorado River system may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes. (C) The provisions of this article shall not apply to or interfere with the regulation and control by any state within its boundaries of the appropriation, use and distribution of water.

DUTIES OF OFFICIALS

"Article V. The chief official of each signatory state charged with the administration of water rights, together with the director of the United States Reclamation Service and the director of the United States Geological Survey, shall co-operate, ex officio: (A) To promote the systematic determination and co-ordination of the facts as to flow, appropriation, consumption and use of water in the Colorado River basin and the interchange of available information in such matters; (B) to secure the ascertainment and publication of the annual flow of the Colorado River at Lee Ferry; (C) to perform such other duties as may be assigned by mutual consent of the signatories from time to time.

"Article VI. Should any claim or controversy arise between any two or more of the signatory states, (A) with respect to the waters of the Colorado River system not covered by the terms of this compact, (B) over the meaning or performance of any of the terms of this compact, (C) as to the allocation of the burdens incident to the performance of any article of this compact or delivery of waters as herein provided, (D) as to the construction or operation of works within the Colorado River basin to be situated in two or more states, or to be constructed in one state for the benefit of another state, or (E) as to the diversion of water in one state for the benefit of another state, the governors of the states affected, upon the request of one of them, shall forthwith appoint commissioners with power to consider and adjust such claim or controversy, subject to ratification by the legislatures of the states so affected.

"Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or direct future legislative action of the interested states.

"Article VII. Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

EXISTING RIGHTS UNIMPAIRED

"Article VIII. Present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact. Whenever storage capacity of 5,000,000 acre-feet shall have been provided on the main Colorado River within or for the benefit of the lower basin, then claims of such rights, if any, by appropriators or users of water in the lower basin against appropriators or users of water in the upper basin shall attach to and be satisfied from water that may be stored not in conflict with Article III. All other rights to beneficial use of waters of the Colorado River system shall be satisfied solely from the water apportioned to that basin in which they are situated.

"Article IX. Nothing in this compact shall be construed to limit or prevent any state from instituting or maintaining any action or proceeding, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions.

"Article X. This compact may be terminated at any time by the unanimous agreement of the signatory states. In the event of such termination all rights established under it shall continue unimpaired.

"Article XI. The compact shall become binding and obligatory when it shall have been approved by the legislatures of each of the signatory states and by the Congress of the United States. Notice of approval by the legislatures shall be given by the governor of such signatory state to the governors of the other signatory states and to the President of the United States and the President of the United States is requested to give notice to the governors of the signatory states of approval by the Congress of the United States.

"In witness whereof the commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the governor of each of the signatory states.

"Done at the City of Santa Fé, N. M., Nov. 24, 1922.

"S. W. NORVIEL,
"W. F. MCCLURE,
"DELPH E. CARPENTER,
"J. G. SCRUGHAM,
"STEPHEN B. DAVIS, JR.,
"R. E. CALDWELL,
"FRANK C. EMERSON.

"Approved: HERBERT HOOVER."

Brief News Notes

Vancouver May Have Two-Million-Dollar Radio Station.—The Canadian Marconi Company, in co-operation with the parent company in England, is contemplating the erection at Vancouver of a wireless station which will permit direct communication with Australia. This would be one of the largest and most powerful radio stations in the world and would probably cost $2,000,000.

Another Lightning Flash Caught by Camera.—Two unusual pictures of lightning flashes have recently been printed in this column—one on page 902, Oct. 21 issue, of a flash photographed in Colorado, and the other on

page 1180, Nov. 25 issue, of a flash photographed in British Columbia. Here is a third, this time taken in Maine, across Little Sebago Lake, about 9 p.m. Sept. 15. The photographer is George S. Liebeck, a student at the Worcester (Mass.) Polytechnic Institute, class of 1923.

Low Lighting Rates for Small Consumers at Memphis.—A reduction from 9 cents to 8 cents per kilowatt-hour in residence lighting rates was ordered at Memphis a few days ago by the Public Utilities Commission. Not only was the kilowatt-hour rate reduced, but the commission also established a rate per room which enables the home owner to enjoy a schedule of 5 cents per kilowatt-hour for all energy used in excess of 6 kw.-hr. This means that the small home owner with a five-room house will get the benefit of the 5-cent rate after burning 30 kw.-hr.

Excelsior Springs Company Buys Three Missouri Plants.—The Excelsior Springs (Mo.) Water, Gas & Electric Company, besides purchasing the Brookfield Light & Power Company, as noted in this column last week, has bought the Edina Light Company and the Merchants' Light & Power Company of Novinger, Mo. The combined capacity of these three newly acquired plants is 1,425 kva. With Brookfield serving six cities 110 miles northeast of Excelsior Springs, Novinger about the same distance northeast of Brookfield and Edina 40 miles northeast of Novinger, the Excelsior Springs company, if it should elect to tie together its present properties, would have a line that would reach from a point about 35 miles east of Kansas City to a point about 35 miles west of Keokuk, or a transmission system almost clear across northern Missouri. The Edina and Novinger plants were purchased from R. V. Bartow and L. A. Nickell.

Associations and Societies

New York Electrical Credit Association.—Addresses from Dr. Albert Grant Walton of Stamford, Conn., and from a leading railroad executive are announced for the twenty-seventh annual meeting and dinner of the New York Electrical Credit Association, to be held at the Building Trades Club on Thursday, Dec. 14, beginning at 6 p.m.

Louisville Engineers Dine Below Ground.—A dinner almost 100 ft. below the street level was enjoyed a week or two ago by members of the Engineers and Architects' Club in a condenser chamber of the new power plant of the Louisville Gas & Electric Company at Third Street and the river. Donald McDonald, vice-president of the company, addressed the club.

Georgia Electrical Association.—Leaders in the electrical industry in Georgia met at the East Lake Country Club, Atlanta, on Nov. 29 for the one-day semi-annual convention of the Georgia Electrical Association. "The Hope of the Electrical Industry—the Contractor" was the subject of an address by A. K. Baylor of the General Electric Company, member of the Joint Committee for Business Development and the wiring committee of the N. E. L. A.

Providence Engineering Society Moves to New Home.—Very desirable new quarters have been secured at 44 Washington Street, Providence, R. I., by the Providence Engineering Society, and the organization held a housewarming at its new home on Dec. 1. The society will henceforth have its quarters in the heart of the city, diagonally opposite the Providence-Biltmore Hotel and near the principal railroad and railway facilities. The quarters include a lecture room with a capacity for 250, a secretary's room, library and lounge. Prof. James A. Hall of Brown University is president.

Coming Meetings of A. I. and S. E. E.—Next Monday, Dec. 11, Charles W. Burrows of New York will address the Cleveland Section of the Association of Iron and Steel Electrical Engineers on the commercial application of magnetic analysis in the iron and steel industry. On Wednesday, Dec. 13, C. J. Strago, Allis-Chalmers Manufacturing Company, will speak on gas engines before the Chicago Section. The Pittsburgh Section will celebrate the sixteenth anniversary of the association on Saturday, Dec. 16.

N. E. L. A. Accounting Section.—The date of the meeting of the executive committee of the Accounting Section of the National Electric Light Association has been advanced one week and the meeting will be held on Thursday, Jan. 18, at 10 a.m., at the Hotel Grunewald, New Orleans. It will be preceded on Jan. 16 and Jan. 17 by meetings of the section committees at the same place. The midyear meeting of the executive committee of the Southwestern Geographic Division will follow, on Jan. 19 and Jan. 20.

Lighting Fixture Men's Program.—For the convention of the Lighting Fixture Dealers' Society of America, to be held in the Hollenden Hotel, Cleveland in the week of Jan. 15, 1923, a program has been arranged which contains the following features: "Strong Economic Position of the Dealer," by J. C. English, Portland, Ore.; "A Practical Program for Better Business and 1923 Business Forecast," by a representative of the Babson Institute; "How to Become a Successful Retailer," by Stanley A. Dennis, editor *Electrical Retailing*; "How Glass Is Made," by a representative of the Illuminating Glassware Guild; general discussion on "What Is the Best Way to Reach Business 'Prospects'?" including papers on personal solicitation, circularizing and newspaper advertising; "How to Make Show Windows Attractive," J. Rodger, Chicago; "Compensation to Salesmen," O. A. Barber, besides addresses by C. H. Hofrichter, business manager of the Lighting Fixture Dealers' Society of America, and Robert Biddle, president of the National Council Lighting Fixture Manufacturers. Selling, buying and "piracy" demonstrations will be staged.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

American Physical Society—Boston, Dec. 26-30. D. C. Miller, Case School of Applied Science, Cleveland.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Eastern Division, Atlantic City, N. J., Feb. 15-16.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Improper Construction Condemned.—Pointing out that it is contrary to standard practice to run electric wires both above and below telephone wires and in some instances less than a foot away, and that inadequacy of rates is not justification for electrical construction that is not only unserviceable but eminently dangerous to human life, the Missouri Public Service Commission, on the complaint of the town of New Cambria, ordered the Bucklin Light & Power Company and the Macon & Chariton Telephone Company to remedy all defective electrical construction in accordance with standard rules.

Security Issues and Depreciation Fund.—The Missouri Public Service Commission has authorized the City Light & Traction Company of Sedalia to make certain stock and bond issues, holding that neither the overcapitalization alleged nor failure to set aside an adequate fund would justify a refusal to sanction securities for extensions and additions. The necessary funds to amortize bonds and interest for replacement must, however, the commission held, when the bonds have been issued because of the failure of the company to set aside a reasonable sum for depreciation, be paid from income to which the company is entitled as return.

Stock Versus Bond Issues. — In granting permission to the Edison Electric Illuminating Company of Boston to issue additional stock to the value of $5,406,700, as reported in the *Electrical World* of Dec. 2, the Massachusetts Department of Public Utilities dealt at length with the objection made by the city of Boston that the company should be compelled to issue bonds rather than stock. Assuming for the sake of argument that it had the power to make such an order, the commission, after summarizing the reasons that led the city to estimate a net saving of 3½ per cent to the company by bond issues and the company to maintain that it would be less than 2 per cent and might be nothing at all, said: "One must not lose sight of the fundamental fact that money raised by the issue of stock is capital, while money raised by the sale of bonds is just as much a debt as if it were borrowed on short-term notes. This is not a mere matter of definition. It is a fundamental practical distinction. Many individuals and business organizations proceed upon the theory that they are best off when they owe least, and many others have done business on the basis of borrowing when the rates were attractive and money could be easily secured. The gas and electric light companies of this commonwealth have, in general, financed themselves through the issue of stock, and there are many who believe that to this fact is to be attributed, to a very great degree, the general financial soundness of these companies. . . . Debts are bound to mean fixed interest charges, and these in their nature are rigid and have got to be taken care of regardless of the times. Money raised from partners or stockholders, which amounts to the same thing, stands in a much more elastic classification. If the times are hard, the dividends can be reduced or dispensed with and the company still continue entirely solvent and able to perform its public functions. We have had in our official capacity some experience with both types of situations. We have seen gas and electric companies, drifting into hard times, reduce their dividends or cease them entirely and yet continue functioning adequately. We have, on the other hand, seen railroads and railways staggering under the burden of fixed charges and reaching a condition unfortunate not only for themselves but also for those dependent upon them for service. . . . After consideration of all the factors which we perceive or which have been brought to our attention, we are not prepared to override the judgment of the company as to the manner in which it deems it best to raise these funds, at any rate where, from the sum of the amounts sought to be capitalized in comparison with the amount for which the company claims that it has the right to issue permanent securities, we are called upon to deal with the question in a partial and incomplete manner."

Considerations Affecting Extension of Service.—In Condon vs. Edison Electric Illuminating Company of Boston the Massachusetts Department of Public Utilities ordered the company to extend its service along a certain street in Boston, saying: "While there are some facts in favor of the company's contention that the neighborhood will retrogress because of the influence of the railroad and the type of buildings which accompany it, we are inclined to think that a study of the district as a whole shows its character to be predominantly residential, of a character which will probably make it a very likely consumer of the company's product. We think that this will depend not a little upon the company's own attitude. We entertain no doubt that, if the company proceeds to deal with this vicinity in an encouraging and enterprising manner the extension of this service will not only be a benefit to those who get it, but will also prove to be profitable to the company. . . . It is the width of the highways and the excellence of the pavement at this point which have tended to prevent those customers from being served. It would be strange if, because the city of Boston had spent substantial sums of money to make this district particularly attractive, that very fact should lead to the denial of one of the standard conveniences of urban life to its residents."

Recent Court Decisions

Right of Commission to Punish for Contempt.—In Van Hoosear vs. California Railroad Commission a writ of prohibition was granted to the plaintiff by the California Supreme Court giving him relief from a citation for contempt entered against him by the commission for refusing to comply with its order to re-establish water service. The court held that the plaintiff was not the owner of the utility and thus was not subject to the order. It announced that an application for a writ of prohibition restraining the commission from enforcing a judgment of contempt, bringing up a complete record, will be treated as an application for a writ of review and where examination of the record shows the petitioner's inability to obey the order relief from the judgment of contempt will ensue. (207 Pac. 903.)*

Power Company Operating Under Contract with City for Five Years Estopped from Asserting Contract to Be Invalid.—The United States Circuit Court of Appeals in Nebraska has declared, in Central Power Company vs. Central City, a case in which the plaintiff held that the contract between it and the municipality was invalid, that where a city, in reliance on contracts with a power company to furnish it with electricity at specified rates, dismantled its own power plant, and the company recognized the validity of the contract by furnishing electricity thereunder for more than five years, and until after the enactment of a statute empowering the city to enter into such a contract, the company subsequently thereto was estopped from claiming that the contract was void because *ultra vires* at the time it was entered into. (282 Fed. 998.)

Power of Virginia Commission Sustained.—The Supreme Court of Appeals of Virginia has sustained the State Corporation Commission's action in increasing electric rates above those named in an ordinance of January, 1914, between the town of Victoria and the Victoria Ice, Light & Power Company. Suit was brought by the town against the company to have the new rates set aside, but the court, sustaining the police power of the state, declared that the power of a municipal corporation to grant to a public service corporation an irrevocable contract for franchise, fixing specified rates, being a surrender of the power of the state government, must be clearly expressed, and all doubts are to be resolved against its existence. A separate action brought by the town against the company to annul its charter on account of alleged illegalities was also decided in favor of the company. (114 S. E. 89 and 92.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

E. L. Kirk Appointed President of Sioux City Service Company

E. L. Kirk is now the president of the Sioux City Service Company, which was consolidated with the Sioux City Gas & Electric Company on Nov. 1. Mr. Kirk was office manager for the Riverside Park Railway Company from 1891 to 1894 and receiver for this company until 1899, when this road and four other lines were consolidated under the name Sioux City Traction Company. He remained as general manager for this firm from 1900 until 1905, when the company was absorbed by the Sioux City Service Company. Mr. Kirk continued as general manager of this concern until his recent promotion to the presidency.

Capt. William McGregor has been elected vice-president of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

Porter Dunlap of McKenzie, Tenn., was elected in the recent general election in Tennessee to the Public Utilities Commission from west Tennessee to succeed W. A. Beasley of Halls, Tenn., who was appointed to fill out the unexpired term of B. A. Enloe, deceased.

Alexander P. McDonald, general manager of the Minnesota Utilities Company, with headquarters at Chisholm, has been appointed superintenden of the Hibbing water and light system. He succeeds W. H. Swartzing, who resigned several months ago on account of ill health.

J. B. O'Neil has succeeded W. A. Campbell as superintendent of the Iron Range district of the Lake Superior District Power Company, with headquarters at Ironwood, Mich. E. O. Sinrud, local superintendent, is acting as assistant superintendent of the Range district.

William H. Atkins, general superintendent of the Edison Electric Illuminating Company of Boston, was the recipient of hearty congratulations Dec. 1 upon the completion of thirty-five years of service with this company, twenty-five of which have been passed in his present position. Various celebrations were held during the day, and Mr. Atkins was presented with a diamond service pin marking his long connection with the company, with a mahogany hall clock from the employees of the operating bureau, with a number of phonograph records containing speeches of congratulation from company officials, and with numerous floral tributes. A special edition of the Waterville (Me.) *Sentinel*, published in Mr. Atkins' birthplace, was prepared in honor of the occasion, and motion pictures of scenes familiar to his boyhood life were shown.

J. A. Britton Elected President of Bohemian Club of California

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has recently been chosen president of the Bohemian Club of California, an organization widely known for its artistic and musical achievement and for the unique feature of the annual Bohemian Grove play, given out of doors in a redwood grove. This grove is the property of the club, of which nearly all of the leaders of the electrical industry in the West are members.

J. A. BRITTON

The honor exemplifies the high regard in which Mr. Britton is held for his personal qualities as well as for his official position. It is only one of a number of honors and responsibilities which have been placed upon his shoulders. He is a regent of the University of California and has been chairman of the San Francisco Chapter of the Red Cross as well as a director of the Panama-Pacific International Exposition. He is an active promoter of the city's musical enterprises and all that is best in her civic life.

Mr. Britton was born in Roxbury, Mass., in 1855, but since his thirteenth year has been associated with California. He is nationally known for his work in the N. E. L. A., where he has served as chairman of the public policy committee, as well as for the important engineering and economic advances of his company under his leadership. He is a member also of the A. I. E. E. and of the A. S. M. E.

Arthur and Damon Join Stone & Webster

Capt. James B. Arthur, Ordnance Department, U. S. A., has resigned to enter the organization of Stone & Webster, Inc., Boston, as an engineer in the electrical division. Captain Arthur was formerly an instructor in electrical engineering at the Baltimore Polytechnic Institute and United States Naval Academy and later was associate professor at Johns Hopkins University. During his service with the government Captain Arthur was also in charge of electrical training at the Aberdeen Proving Grounds in Maryland.

John C. Damon, formerly superintendent of service, West Penn Power Company, has also joined the engineering department of Stone & Webster. Mr. Damon is well known in central-station circles. During the war he served as major of engineers in charge of the development and control of the power supply of the eastern Ohio district, besides taking part in the investigation for the government of the power resources of New England.

J. P. Thompson, formerly assistant treasurer of the California-Oregon Power Company at Medford, has been made assistant general agent of that company.

Harry F. Dart, formerly instructor in electrical engineering, Harvard University, is now engaged in research work for the Westinghouse Lamp Company, Bloomfield, N. J.

C. P. Soderberg, formerly with the Cleveland Wire & Cable Company, Cleveland, is now connected with the merchandising division of the Westinghouse Electric & Manufacturing Company's Los Angeles office.

E. A. Martin has taken charge of the transformer department of the Chicago office for the Wagner Electric Corporation. He was formerly in the Chicago motor division of this company.

E. A. Grimmer, Fred W. Ryder and **Murray Russell** have recently joined the sales force of the Elliott Company, manufacturer of power accessories at Pittsburgh and Jeannette, Pa. In addition to Elliott products they will also sell those manufactured by the associated companies, the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield, Ohio.

S. W. Henderson will remain general manager of the Edina (Mo.) Light Company and the Merchants' Light & Power Company of Novinger, Mo., which have been acquired by the Excelsior Springs Water, Gas & Electric Company. Percy Markham, for many year manager of the Brookfield (Mo.) Light & Power Company, will continue as manager there for the Excelsior Springs Water, Gas & Electric Company, which has acquired the Brookfield properties, serving six cities in northeastern Missouri.

S. F. Sowers is now president of the Greenlane (Pa.) Light, Heat & Power Company, replacing S. S. Hartzell.

B. F. Thornton is now chief electrician of the municipal electric light plant at Columbus, Ohio, replacing H. F. Fisher.

W. B. Voth is now manager of the Eastern Dakota Electric Company, Watertown, S. D., replacing M. A. Harrison.

W. A. Buchanan is now assistant district manager of the Kentucky & West Virginia Power Company at Logan, replacing P. H. Powers.

C. E. Blee, formerly assistant general agent for the California-Oregon Power Company at Medford, Ore., has been made assistant engineer.

G. R. Bullock is now secretary and treasurer of the Mount Hope Electric Power & Water Company, Mount Hope, W. Va., replacing N. R. Waldo.

A. T. Gustad, formerly connected as electrical engineer with Murrie & Company, New York City, is now connected with the American Gas Accumulator Company, Elizabeth, N. J., as designing engineer.

Lynn G. Barnes, formerly with the General Electric Company at Schenectady, N. Y., is now resident engineer and electrical superintendent for the International Paper Company at Franklin, N. H.

P. D. Lawrence has been appointed superintendent of power for the Hortonia Power Company, Brandon, Vt. H. H. Perry of Chicopee, Mass., is to take his place as local manager at Bristol, Vt.

Earl R. Witzel has resigned his position as manager and treasurer of the Groton Electric Company, Groton, S. D., and has become vice-president of that company. He is organizing a two-year electrical course at the University of Wyoming.

Frank M. Williams, nominated for the office of State Engineer in New York State seven times and five times elected, who retires from office on Dec. 31, will ally himself with the Technical Advisory Corporation of New York, an organization composed of consulting engineers.

William W. Brennan has been transferred from the engineering department of the Edison Electric Illuminating Company at Brockton, Mass., to the Whitman office, where he will act as general agent of the company in the towns of Whitman, Hanson and Pembroke.

R. W. Everson, sales manager of the Mexican branch of the Westinghouse Electric International Company, has been appointed district manager of the Atlanta office of the Westinghouse Lamp Company. He succeeds Julien Binford, Jr., resigned. Mr. Everson has been associated with the Westinghouse industries for more than twenty-four years and has held a number of important positions.

H. P. Currin, engineer associated with the Eastern Oregon Light & Power Company for the past four years, has resigned his position, and the vacancy has been filled by H. C. Miller.

Melvin D. Engle has resigned his post with the Consolidated Gas, Electric Light & Power Company of Baltimore and is now connected with McClellan & Junkersfeld, New York City.

H. W. Rose, engineer of the Victoria (Tex.) Electric & Ice Company for the last two years, has resigned to become general manager of the H. W. Rose Manufacturing Company, which has just been organized in Victoria.

Colorado Elects Electrical Man Governor

William E. Sweet, well known to the electrical industry in Colorado, was recently elected Governor of that state on the Democratic ticket in one of the closest campaigns ever waged in the

W. E. SWEET

Rocky Mountain region. Governor-elect Sweet, who is a banker and financier, has prominent connections with the electrical industry in Colorado and the surrounding states. He is vice-president of the Albert Sechrist Manufacturing Company, manufacturer of lighting fixtures and electric pressure cookers, is financially interested in an electric utility in Nebraska and has extensive holdings in Colorado industrial organizations.

Theodore E. Burger has joined the general staff of the Western Electric Company at the headquarters office, New York. For the past year and a half Mr. Burger has been secretary of the Society for Electrical Development, Inc. In making this change Mr. Burger will be again connecting himself with the organization in which he obtained his first electrical experience, he having started with the Western Electric Company at Los Angeles in 1905. He was manager of the branch in that city from 1907 to 1917. He was one of the early presidents of the Los Angeles Electric League.

H. R. Van Deventer, formerly associated with the bureau of patent development of the Westinghouse Electric & Manufacturing Company, has been appointed vice-president in charge of research, manufacturing and patent development of the Dubilier Condenser & Radio Corporation, New York City.

Obituary

Charles B. Fithian, who was associated with Albert Gentel, Inc., electrical contractor-dealer of Philadelphia, for twenty-five years, died on Nov. 25. Mr. Fithian was well known in Philadelphia electrical circles.

Frank W. Smith, general manager of the Sundh Electric Company, Newark, N. J., died recently at the age of fifty-two while playing on the Echo Lake Golf Club course at Westfield. Mr. Smith was a pioneer in the field of electrical control. He had been associated with the Sundh company for eighteen years.

John A. Tracy, head of the New York Telephone Company in Hudson County, N. J., died recently at the Greenville Hospital, Jersey City, following an operation for appendicitis. Mr. Tracy rose from a clerkship in the telephone company to the head of the Hudson division in fifteen years. He was forty-two years of age.

Ralph L. Clarke, assistant manager of the San Diego Consolidated Gas & Electric Company, died in November after an illness of two months. Mr. Clarke had been associated with the company since 1886, when as a young engineer, trained by his father, he joined the Jenney Electric Company, the forerunner of the present company. Rising to be chief engineer and superintendent of electric production, Mr. Clarke was an important factor in the growth of the company. When it was acquired by H. M. Byllesby & Company in 1905 he remained as general superintendent. About two years ago he was made assistant manager.

Leon Vail Garron, manager of the supply department of the Philadelphia Electric Company, died at his home in Woodbury, Pa., on Nov. 23, a victim of pernicious anemia. Mr. Garron became associated with the Philadelphia company in 1899 as a solicitor for the Edison company, but resigned one year later to become connected with the General Incandescent Arc Lamp Company. In 1906 he returned to the Philadelphia Electric Company as assistant manager of the supply department, and he succeeded H. C. Lucas as manager when Mr. Lucas became treasurer of the company in 1911. Mr. Garron was a member of the executive committee of the Electrical Supply Jobbers' Association. He was forty-four years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Need for More Electrical Statistics

Manufacturers Should See that the Industry Is Represented Adequately in the Department of Commerce "Survey of Current Business"

By L. S. Horner
Vice-President the Acme Wire Company

APPARENTLY few manufacturers in the electrical industry realize the opportunity which is offered them through the United States Department of Commerce to compile current facts on production, consumption and stocks as usable statistics of their particular industry, otherwise they would certainly have taken alvantage of it to some extent during the past twelve months. It is significant that out of twenty-seven basic industries reporting in the *Monthly Survey of Current Business* as groups only two related even remotely to the electrical industry are included, namely, electric power and copper.

New Viewpoint Toward Business

Great credit should be given Herbert Hoover, the Secretary of Commerce, for his business vision in realizing that census and biennial reports on manufactured products are of interest as history but of no practical value to the active executive who wants current facts showing the trend of activity in all industries. Many business men who heard Mr. Hoover's speech before the United States Chamber of Commerce at Atlantic City in May, 1921, realized that a new era had apparently dawned in the relations of government to industry, and thanks to his driving force, coupled with a business man's point of view, the country has been offered an opportunity to have facts presented in concrete form covering all leading industries, provided that the industries are sufficiently interested to organize themselves so as to furnish the details either through an association of the leaders of the particular industry or by arranging to have details sent to the Department of Commerce and put in proper form for the *Monthly Survey*.

It is assumed that every electrical manufacturer agrees that current facts on such activities as bank clearings, foreign trade, car loadings, idle cars, building activity, steel, copper, rubber, vapor and other products are vitally necessary to run any business intelligently. Why not, therefore, tie into these figures corresponding facts regarding the electrical industry, covering its main activities?

Prosperity or depression trends apply equally to all allied businesses, and the electrical industry has failed to realize its obligation as an industry to make public and give to its customers accurate statistics regarding conditions in the industry. Such information must aid the growth of the electrical art and over a period of years cannot possibly injure any individual interest. The facts, if properly collected by an association, and certainly if given direct to the government, are strictly confidential as regards any individual manufacturer. And if we do not give, we ought not to get.

Some old well-established electrical firm may say, "The facts of my industry are well known to me through a most efficient sales organization." I refuse to agree that such knowledge can be accurate. It must largely be based on the statement of the buyer to the salesman. These statements are frequently inaccurate, intentionally or otherwise. The only reliable facts are production, distribution, stocks and comparative market prices obtained by hearty co-operation from every manufacturer of a given group and distributed monthly by the government in a brief form, where a glance at a table or a group shows the trend of all industries. Is it not better to have this general information in one brief form so that we can see the trend, rather than have to go to a dozen or more publications covering a particular activity and collect from each what we are particularly interested in?

A thorough survey of any subject necessitates a complete study of the subject, but the busy executive must conserve his time and yet have his decisions based on general facts. Why, therefore, object to giving information about your own business, if you benefit by facts given through allied industry?

We certainly agree that it is not good business to base your production or expand your facilities on anything except facts, but the only way to get them is to do your part by indicating in what general direction your industry is going—toward an increasing or decreasing demand. Furthermore, the electrical industries should be just as much interested in their customers knowing what the real conditions are as in knowing this themselves, because such knowledge is constructive and betters the electrical industry as a whole, and the individual manufacturer shares the general benefit. Is it not true that if facts regarding production and distribution of electrical products had been better known to all of us in 1920 there would not have been such high-priced inventories to liquidate on Jan. 1 of 1921 and 1922?

Individual Action Needed

The questions, therefore, for each manufacturing group of the electrical industry to consider and decide are these:

1. Shall we request the Department of Commerce to include in the *Monthly Survey of Current Business* statistics regarding our business?
2. In what form shall the statistics be published to give us a quick picture of the trend of our business?
3. How shall the confidential figures from each company be intelligently tabulated and promptly transmitted every month to the Department of Commerce?

The past twelve months' experience in publishing this survey

makes the problem now comparatively simple. Mr. Hoover has appointed a direct representative of his department for the electrical industry, and co-operation and interest can confidently be expected by any manufacturer who takes this matter up with this representative. But let me emphasize this fact. There must be hearty co-operation of the industries contributing the information. Figures obtained by compulsion are of little value. They must be furnished freely, and a manufacturer who furnishes them must realize that the information is for his own benefit as well as for the benefit of his customers and other allied business.

W. M. Steuart, Director of the Bureau of the Census, has stated: "The bureau is perfectly willing to have any individual manufacturer make his report under a code, and under the provisions of the law in regard to confidential data, it will collect the reports and assemble them, to be included in the survey."

Trade Congestion Cramps Our Retail Selling

Conditions Vary with Communities—The Position of the Central Station and Its Increasing Influence in Local Distribution—Three Things to Do

BY A MANUFACTURER

THERE is a natural tendency on the part of men in all lines of industry to feel that things as they are are right and must continue. And because they think from this viewpoint they are inclined to resist trends and influences that indicate impending change.

Not many years ago, for example, the electrical jobber was disposed to take the position that he was entitled to first consideration in the scheme of merchandising merely because he was established. Today, however, I think jobbers realize that they are but one link in the chain and that they must demonstrate their absolute usefulness as part of the distribution machinery for every particular product or be dropped out of the chain as far as that product is concerned. They realize also that there is a limit to the number of dealers that can survive at all in a given community.

CONGESTION OF CONTRACTORS

At the present time there are too many dealers and too many contractors in the electrical industry. The congestion seems to have come about from natural causes. The industry has developed and spread so rapidly that it has afforded means of a temporary livelihood for many who have not been qualified to do business of any kind on scientific and economical lines. The radio craze of last year is a striking example of a development that drew in innumerable little manufacturers and traders who have since been dropping out again in great numbers because they were not qualified to stay in the business. Moreover, one of the great errors in our situation in my opinion is the wholesale union of so-called contractor-dealers. This has brought about an unsatisfactory situation on the contracting side of the business and hampered wiring development in a marked degree. On the other hand, it has multiplied incompetent dealers to such an extent that there is no room for them in the industry. Almost every community has more dealers in it than can possibly make a good healthy profit even if they have the whole available discount over the manufacturers' commercial cost.

But now, I believe, we are going to see the contractors get back into their regular line of business and by efficient methods eliminate the army of so-called "basket" contractors that have sprung up because the legitimate contractors have neglected their regular work. We are also, I hope, going to see the number of retail outlets reduced to a reasonable number in each community. This will bring about a more healthy condition in the industry and a better balance in our distribution.

For say thirty years past we have been going through a period of the most astonishing development in the way of invention, opening up one vast possibility after another. This has naturally drawn in the irresponsible elements that are now causing congestion. I believe we are now going into a period that will be as remarkable as the thirty years that have passed, but marked more particularly by the application of things electrical in every form and the establishment of the merchandising and distribution branches on a stable basis by the development of the legitimate elements in the business and the elimination of those that are superfluous or inefficient.

CENTRAL-STATION INFLUENCE VITAL

Every one connected with the merchandising of electrical products must remember, furthermore, that the central station is not merely an important factor but is the nucleus around which we must build our business. Generally speaking, and omitting the factor of isolated plants, the sale of all electrical apparatus and merchandise in every community depends for its growth on the service of the particular central station of that community, and that particular central station will inherit the trouble from any energy consuming devices attached to its lines. Therefore the central station is interested in seeing that the dealers do not sell inferior material, and the dealers in a given community cannot in the long run prosper if they sell inferior material and continually sow the seed of trouble for the central station.

It must also be borne in mind that all electrical appliances have been largely distributed during the pioneering period by house-to-house selling methods. This house-to-house canvassing has become a nuisance in many communities. It is also an

Employees Engaged in Manufacturing

THERE are 10,800,000 persons now engaged in work in the manufacturing plants of America. This chart shows the number who are wage earners as compared with the salaried employees, represented by the shaded area, and proprietors or firm members, indicated by the black dot.

expensive method and in the long run must be abandoned or very considerably modified. The central station is the only organization that has physical contact with every possible electrical customer in the community and can maintain effective house-to-house contact without offense and also in the regular course of business make a chart of the community and know exactly what appliances are in each household. The development of central-station commercial activities and co-operation of the other branches with the central stations therefore becomes increasingly vital.

Gradually all these elements and factors will be resolved and find their place in the operations of the industry.

THREE THINGS TO DO

Without expecting to solve the whole problem promptly, if I were in the jobbing business under present conditions, I would give early attention to a few outstanding points:

1. I would study this central-station question and capitalize it by working with the central station, to influence the contractor to do a more complete wiring job and teach the dealer that he must sell high-class reliable products in order to endure in a given community.

2. Then I would ask the central station to encourage officially the use of high-class products such as I would distribute by making it known to the dealers that the sale of inferior material was looked upon with disfavor and if persisted in would lead necessarily, in the interest of good service, to regulations requiring approval of any product before it could be connected to the central-station lines.

3. Then I would turn to the contractor-dealers and urge all good contractors to go after wiring business and put it on a proper basis. I would urge them to drop merchandising where it does not show them a clear, healthy profit. In this way I would try to do away as far as possible with the innumerable incompetent dealers and "basket" contractors.

If I could make any considerable headway on these points, I believe, I should be well satisfied to devote a year to it before thinking of any other part of the problem.

Survey of Business Conditions

Chicago November Motor Sales Equal October's

Sales of motors for the Middle West territory for November have maintained the level established in October. Of five motor manufacturers, three report an equal volume of sales while two report increases. One of these companies asserted that its sales averaged a 10 per cent increase, while another firm declared that its Chicago sales for November increased 40 per cent over October. A large majority of sales are under 10 hp. for use in various fields, including the pump and elevator industries. Industrials have not been buying the larger sizes. Stocks are in good condition and prices remain firm.

Puts Radio Business at Fifty to Sixty Millions a Year

Radio business is now proceeding at the rate of from fifty to sixty million dollars a year, according to E. E. Boucher, sales manager of the Radio Corporation of America, who spoke before the recent jobbers' convention in Cleveland. He predicts that before Dec. 15 sales will have accelerated so that jobbers' stocks will be cleaned out.

"Experience has shown," he said, "that the department store is not making a success of radio. Some music stores have done a good job, but the electrical man has proved himself to be in the best position and will carry away the business if he will set himself to sell complete units by progressive merchandising methods. The sale of parts will continue to the amateur experimenter, but there will be separate fields for development."

More Intelligent Buying Has Entered Radio Parts Market

Radio-equipment buyers are becoming more particular when buying parts, according to the observation of several New York City merchants specializing in parts. One of them points out that amateurs are asking questions about the outstanding features of this or that part in a more noticeable degree than when the first wave of radio popularity swept the country a little more than a year ago. The matter of price makes no difference to these purchasers. Quality is wanted, he says.

Assembling of parts into efficient sets by schoolboys is being taken more seriously this year, says a leading dealer in the upper west side of Manhattan. Some boys in that neighborhood, he says, have formed a club whose leader buys their parts in collective quantities at reduced prices. This retailer relates a story of a high-school student who refused an inferior make of telephone head set at a very low price and instead placed a small deposit, all that he possessed, on a set which costs almost twice as much, explaining that he would prefer to wait a few weeks in order to get "something that will last."

Urges Flat-Rate System for Service Stations

M. B. Speer, service manager at the Westinghouse Electric & Manufacturing Company's East Springfield plant, addressed the New England Section of the Society of Automotive Engineers in Springfield, Nov. 24, on "Electrical Service." He said few electric service stations are organized and run efficiently and recommended that engineers employ their influence for better arrangements both in the matter of shop equipment and checking up costs. The flat-rate system is recommended to service stations as best.

Faulty work in rewinding armatures was mentioned as a source of loss and trouble in many maintenance establishments, and the extensive sale of unguaranteed and spurious parts was cited as a source of demoralization. The manufacture of inferior apparatus and parts and the springing up of a host of small dealers and service concerns, taken together, has brought about a decidedly unsatisfactory state of affairs, he asserted, and one that in justice to the public and legitimate concerns must be met with concerted opposition. It is the duty of engineers, by intelligent advice, the speaker said, to become a regenerating force in these matters.

Outlook for Washing Machines Is Promising

The constant increase in washing-machine sales is seen in recent reports from that market in all sections of the United States. During the early months of 1922 little activity was shown for this appliance, but since the first days of July orders have been coming in at a rapid rate. Intensive selling efforts by house-to-house canvassing, displays at the agricultural fairs and the "home electric" shows by different electrical clubs and societies have done much to bring about the added interest.

Great activity is shown in the Far West. In San Francisco it was reported several weeks ago that October business has set new records for the past twelve months, but that in some cases the jobbers are reporting rather poor sales for November. One distributor reported that one crew of thirty men sold 120 machines in October, having been assisted by a list of "prospects" secured at several agricultural fairs. Stocks are good in Salt Lake City, where it is reported that several aggressive washer and vacuum-cleaner campaigns were launched in

October, although the response was not particularly gratifying. In the Cleveland territory it is reported that all standard makes are in good demand, jobbers having sufficient orders on hand to insure activity until after the holidays, while manufacturers report production easily absorbed. In Denver central-station campaigning is stimulating interest. Sales in Portland and Seattle have exceeded in many cases the expectations of the dealers, with a consequent shortage in many lines. There is increased activity in the Southern and Eastern territories.

Chicago Industrial Activity Showing Upward Trend

Increased employment and industrial activity in the Middle West have established a new record of electrical energy used, according to figures compiled by the Federal Reserve Bank of Chicago. The September production of electrical energy increased 19.8 per cent over the same month in 1921, while the number of industrial users advanced 8.1 per cent. Increased employment in Chicago is indicated in the reports of the surface and elevated lines made to the Illinois Commerce Commission. The surface lines handled 4,300,000 more passengers in October than during September, while the elevated lines reported a 5 per cent increase in business.

October Eectrical Exports Decline $115,282

Exports of electrical supplies in October show a decrease of $115,282 below September and were $247,559 lower than October, 1921, when they amounted to $5,371,030. In October, 1920, exports of electrical goods amounted to $9,988,215. Few finished manufacturers' exports have lately developed more strength. Normally this trade is hampered by rapid invention and variability of price lists. For the past eighteen months American exporters have also had to contend with renewed competition from a half dozen leading European markets well established in special lines of output many years before the war.

Electrical exports for October, 1922, are shown in table below.

ELECTRICAL EXPORTS FOR OCTOBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	October, 1921 Value	October, 1922 Value
Turbines	.....	$26,965
Generators	$779,338	.....
Direct-current—		
Under 500 kw	.....	32,509
Over 500 kw	.....	133,363
Alternating-current—		
Under 2,000 kw	.....	19,780
Over 2,000 kw	.....	165,390
Accessories and parts for generators	.....	44,661
Self-contained lighting outfits	.....	32,265
Batteries	211,758	.....
Primary—		
Dry	.....	79,714
Wet	.....	4,872
Storage	.....	165,044
Transforming and converting apparatus:		
Transformers	464,281	.....
Power	.....	84,191
Other	.....	33,574
Rectifiers	.....	4,929
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	.....	50,448
Transmission and distributing apparatus:		
Switches and accessories	176,154	.....
Switches and panel boards, except telephones	.....	252,640
Switches and circuit breakers	.....	119,424
Fuses and fuse plugs	.....	19,652
Meters and measuring instruments	161,462	.....
Watt-hour and other measuring instruments	.....	53,003
Volt, watt, and ampere meters and other recording, indicating and testing apparatus	.....	66,691
Lightning arresters, choke coils, reactors and other protective devices	.....	35,535
Motors, starters and controllers:		
Motors under 1 hp	.....	83,791
Stationary motors—		
1 to 200 hp	.....	156,018
Over 200 hp	.....	24,794
Railway motors	.....	112,158
Electric locomotives	236,845	.....
Railway	.....	10,000
Mining and industrial	.....	19,779
Other motors	525,142	6,685
Rheostats, controllers and other starting and controlling equipment	77,735	62,246
Accessories and parts of motors	.....	63,874
Electrical appliances:		
Electric fans	$15,444	$45,575
Electric lamps:		
Arc	1,250	3,828
Incandescent—		
Carbon-filament	3,980	2,893
Metal filament	104,889	138,022
Other electric lamps	.....	20,152
Flashlights	.....	31,896
Searchlights and projectors	.....	89,196
Motor-driven household devices	.....	83,928
Domestic heating and cooking apparatus	74,302	76,789
Industrial electric furnaces and ovens	.....	46,279
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	.....	64,862
Signal and communication devices:		
Radio and wireless apparatus	.....	564,803
Telegraph apparatus	42,769	38,887
Telephone apparatus, including switchboards	163,397	433,016
Police, fire and burglar alarm apparatus	.....	10,285
Railway signals, switches and appurtenances	.....	28,733
Bells, buzzers and annunciators	.....	6,760
Other electrical apparatus:		
Spark plugs, magnetos and other ignition apparatus	78,890	88,373
Insulating material	.....	80,542
Metal conduit, outlet and switch boxes	.....	14,662
Sockets, outlets and receptacles	.....	75,449
Other wiring devices	86,822	143,968
Other electrical apparatus, not elsewhere specified	1,798,655	425,755
Globes and shades for lighting fixtures	.....	40,089
Electric glassware, except for lighting	.....	15,976
Electrical porcelain	.....	72,606
Carbons for electric lighting electrodes and batteries	26,526	93,330
Insulated wire and cables (iron and steel)	.....	31,327
Manufactures of aluminum including wire	96,955	93,874
Copper:		
Bare wire	66,900	128,794
Insulated wire and cable	177,536	170,827
Total electrical machinery apparatus and appurtenances	$5,371,030	$5,123,471

Says Electrical Situation in Orient Is Improving

"The general business situation in China is improving," said Julean Arnold, commercial attaché to China, to a representative of the *Electrical World* last week in San Francisco. "It is true that the political situation continues bad, but this does not affect the country as a whole nearly so much as does the political situation in the United States.

"The outlook for foreign export to China of electrical goods is very encouraging, but it is well for American manufacturers to remember that they must have a financial organization to handle the credit situation if they wish to do extended business in China. Three American firms, the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Electric Company, have already strong organizations in the Orient and other electrical manufacturers are seeking to gain admission there."

The Metal Market

Copper, Zinc and Tin in Small Demand—Lead Price Advances to 7.10 Cents

Copper, zinc and tin have been in small demand during the last week. Lead has continued strong.

There are more copper sellers at 13⅞ cents delivered today than there were a week ago, and there is no difficulty in getting large amounts of copper for delivery over the next two or three months at this level, where the freight rate is not more than 25 cents per 100 lb. On some desirable business the price has been shaded to 13.80 cents. Two or three lots have been offered by second-hands, and this metal is reported to have been obtainable at 13.75 cents.

NEW YORK METAL MARKET PRICES

	Nov. 29, 1922 Cents per Pound	Dec. 6, 1922 Cents per Pound
Copper		
Prime Lake	13.75	13.87½
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	7.00	7.10
Antimony	6.50	6.50
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	21.50	21.50

The official contract price of lead of the American Smelting & Refining Company was advanced from 7 to 7.10 cents on Nov. 24.

The advance of the smelting company brought its price about to the level of outside interests for December and January lead. At the new level lead was in freer supply and more was sold for Eastern delivery than for some weeks. For prompt and spot lead premiums continue to be asked, and 7.25 cents would no doubt have to be paid, though practically none is being sold, so that the influence of this price on the major market is practically nothing.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IMPROVING business in appliances, motors and lamps is reported. Central-station buying has fallen off noticeably during the past week and little further activity for the next two months is expected. Holiday purchases of flatirons, toasters, novelties, vacuum cleaners and washing machines are heavier, although, because of Thanksgiving Day, the volume of sales for last week was not larger. Conduit stocks, particularly in the Far Western sections, are very low, and jobbers express grave fears for the future. An official of an important radio corporation stated before a meeting of jobbers in Cleveland last week that sales are now proceeding at the rate of from fifty to sixty million dollars a year.

New York

Pole-Line Hardware Demand Falls Off —Holiday Buying Continues Brisk — Fixtures Active

Although last week's volume of business was reduced because of the holiday, there was a considerable impetus given to sales during Friday and Saturday. Much activity in appliances, motors and fixtures is being shown in the present market and there is every indication of further improvement.

Pole-Line Hardware.—Demand has fallen off considerably and there is little activity in new line construction by central stations. Insulators are quiet.

Appliances.—Cooking and heating appliances are arousing more interest, and prices are reported slightly lower because of extreme competition in some instances. Vacuum-cleaner and washing-machine sales for November are said to be in excess of those for October.

Fixtures.—Much activity is reported for commercial sizes. With the completion of many homes in New Jersey and Brooklyn, a good amount of business is going in that direction.

Radio.—Much improvement is noted, and holiday buyers are taking the heavy stocks held over for many months. Dealers report more careful and intelligent purchasing. Prices are reduced.

Chicago

Wiring Demand Good—High-Tension Material Brisk—Motor Sales Lively —Radio Advancing

Business in the electrical industry has had another good week. Although few changes in either demand or price were announced, jobbers report that their main volume continues to swing along briskly. Wiring materials are still in active demand. The high-tension manufacturers reported another lively week. Statements from manufacturers relative to November motor sales indicate that they have equaled or even bettered October's sales.

Wire.—Reports from jobbers indicate that the volume of wiring material sold during the past week is still steady.

High-Tension Equipment.—All firms report a continuing active week. One firm sold a 132,000-volt, 6,000-kva. outdoor substation to a Middle Western utility and two 66,000-volt, 3,000-kva. substations to another Western utility. Another company reports brisk business on 33,000-volt and 66,000-volt fuses.

Motors.—Sales on motors for November have equaled the volume sold in October. Most of this equipment is under 10-hp. for use in the motorization of standard machinery, including lathes and machine tools. Motor stocks are in good shape and prices are firm.

Fuses.—The call for the 30-amp. fuse has increased slightly, which jobbers attribute to the seasonal demand for better lighting systems. Stocks are normal.

Radio.—With the advent of the opera season, an improved demand for radio has been noticed, although the main volume is not so great as expected. Stocks are in good shape since both vacuum tubes and head sets are available.

Boston

Lamp Demand Active — Brisk Motor Business—Weatherproof Wire Quiet —Irregular Conduit Deliveries

Gradually improving business is reported in all parts of electrical New England. General industry is gaining, and while conditions have not reached normal in the textile field, they are growing better. Central-station energy sales are increasing with great rapidity. Building operations continue to absorb much new capital, and so far labor conditions appear in better shape than in some other sections. Retailers of electrical goods are well "set" for a heavy holiday trade. Jobbers' stocks in Boston are showing none too much margin over current requirements, and deliveries from outside New England are greatly hampered by railroad embargoes. Prices are firm and tend to stiffen in flexible armored conductor and weatherproof wire.

Lamps.—The demand is very active and stocks are comfortably meeting it. Small mercantile establishments are responding to sales efforts by lighting departments of central stations and dealers.

Motors.—The rate of increase in business over last year continues to be well maintained, with some fluctuations above or below in comparing particular weeks now and twelve months ago. Second-hand stocks are being depleted, and much interest is evident among appliance manufacturers, who are now considering their fractional-horsepower motor needs in 1923.

Wire.—Rubber-covered wire is moving very actively on building construction jobs. Weatherproof is quieter, although prices trend upward in the additions for sizes above the current base. Deliveries are in good shape, especially from New England factories. Bare wire is dull.

Rigid Conduit.—Scarcity prevails in some sizes among local jobbers, but by "shopping around" immediate needs can usually be met. Deliveries are irregular and uncertain, owing to railroad embargoes.

Cleveland

Radio Improving—Good Wire Stocks— Porcelain Prices Reduced—Heater Demand Falls Off

Judged by the volume of traffic offered to the railroads, general business maintains itself satisfactorily. Moderate weather in November has relieved the traffic congestion of the month before and car loadings continue at a rate not much below the record of two years ago. Radio has shown much improvement and conduit has become more available. Prices generally are firm and distribution is fairly equal between advances and declines.

Wire.—Activity in No. 14 rubber-covered continues, but from good stocks. A slight tendency to advance prices is noted.

Conduit.—Although stocks have been recovered, the demand for the larger pipe continues in good volume. Prices have not yet indicated a decline. Armored cable is steady and prices are firm.

Poles and Pole Line Hardware.—Fair activity is noted and one jobber reports stocks reduced. Prices are firm.

Porcelain.—A limited market and large stocks have had a tendency to reduce prices.

Lamps.—Smaller types continue to be in good demand despite partial suspension of building activity. Dealers are prepared for an expected activity in Christmas-tree lamps. Commercial fixtures and wiring devices are steady, but dealers are not recovering stocks.

Heaters.—Demand has fallen off sharply, but this is due to mild weather and prices remain firm. The holidays and colder weather are expected to create an active market by next week. Stocks are normal.

Radio.—Jobbers and dealers report greater demand with the regaining of popularity. Many dealers are reducing current stocks with sales.

Atlanta

Heavy Movement of Armored Conductor — Meter Stocks in Good Shape—Fuses Active

Business conditions in general in the Southeast remain about the same. The long drought continues, but the ability to obtain cars for coal shipments is tending to relieve the situation and no curtailment of power is expected at the present time. Jobbers and dealers report the trade as very brisk and the outlook bright for a big holiday season. Stocks are in excellent shape. Collections have improved during the past sixty days, but jobbers expect them to slow up until the first of February on account of the holidays.

Armored Conductor. — A steady movement is reported, with the building program indicating a continuation of satisfactory sales. Only fair stocks are on hand, but deliveries are good.

Meters.—The movement in this line is fair to good, the best sales being reported in the 5-amp. and 10-amp., two-wire sizes. Stocks are in good shape with prices steady.

Fuses.—The fall demand is in evidence, both in plug, cartridge and renewable types, with an increasing tendency on the part of industrial plants to standardize on the renewable fuse. Stocks and deliveries are good.

Commercial Lighting Fixtures. — Building activities throughout the section are responsible for a steady movement in this line. The tendency is toward purchasing the better class of fixture. Stocks are good, but deliveries are only fair to good.

Schedule Material.—The demand in this line is excellent, particularly for sockets, rosettes and snap switches. Sufficient stocks are on hand to meet the requirements.

Motors.—An increase in motor sales is reported and deliveries are beginning to lengthen. Spotty stocks are in the territory. Prices are steady.

St. Louis

Air Heaters Are Steady—Lower Tape Prices—Trucks Attracting Renewed Interest

The midweek holiday caused substantial reductions in sales last week; in fact, buying generally shows decreasing tendencies except for the holiday demand. On the other hand, manufacturing plants are operating on increasingly heavier schedules, especially the stove, furniture, automobile and steel plants. Power equipment continues to be one of the most active lines, and sales for the week were of good volume. Central-station energy sales and power-plant demands are making new records. Collections show improvement, some reporting them on a forty-five-day basis, and many of the long-standing obligations have been liquidated. Money rates are lower and loans are more readily made. Money and credit conditions in the South are substantially better since this year's crops have been sold.

Air Heaters. — Favorable weather conditions are causing steady sales, both wholesale and retail. Dealers are keeping low stocks, and those of jobbers are moderate.

Tape.—Prices are slightly lower, representative quotations in 50-lb. lots being 35 cents per pound in both friction and rubber. Demand is falling, with stocks conservative but ample.

Ironers.—A distributor reports that sales are about double those of last year, the increased demand being a result of consistent educational work. Stocks are excellent.

Electric Trucks.—This business has been dormant in St. Louis for a number of years, but renewed interest exists, bakeries and laundries being recent purchasers, and it seems probable that a number of concerns will adopt them next year.

San Francisco

Conduit Stocks Are Very Low—Schedule Material in Demand—Lamp Stocks Fair

Local stocks in general are in good shape, although conduit and some wires are badly needed.

Conduit.—November showed slight improvement over October. Comparatively few carloads were received, and these were immediately broken up for urgent jobs. Occasional raising of eastbound embargo enables a few carloads to be shipped from mills to Atlantic Coast for re-shipment by water. Many urgent calls were satisfied by substitutions of brands, but at the present time there are almost complete shortages up to and including the 2-in. size.

Schedule Material.—Record-breaking building added to local campaigns for convenience outlets have produced heavy and it is thought steady demand. Prices are fairly steady now after a general advance. There have been individual shortages but no general dearth.

Lamps. — Demand is very good. Stocks are fair. Several jobbers report that 1921 carry-overs are now sold and that their new stocks are being drawn upon. Fancy lamps are rather slow.

Batteries.—Dry-battery sales hold up surprisingly well, according to local manufacturers.

Flashlights.—Selling well above last year's volume.

Salt Lake City

Merchants Co-operating in National Advertising Campaign—Porcelain Is Active with Inadequate Stocks

Merchants in this territory are co-operating quite generally with the national advertising campaign for electrical Christmas gifts. Stocks that will be called for during the holiday buying are in good shape generally. In some instances, however, immediate delivery cannot be made on orders for hollow ware. The market is an active one for porcelain, with stocks inadequate. Building activities have slowed down since stormy weather set in. The tax-paying exigency has been felt adversely in collections, but the general tendency is in the direction of improvement.

Portland–Seattle

Conduit Continues in Steady Demand —Stocks of Outlet Boxes Low with Slow Deliveries

Lumber production is still above normal and shipments are increasing. General export shipments were less for November than they were a year ago owing primarily to a shortage in the wheat crop. This is offset to some extent by the greatly increased fruit shipments. The number of building permits for November was slightly less but the value appreciably greater than for the same month last year. Building for the first eleven months of 1922 is greater than for the same period in 1921 by at least 30 per cent. Postal receipts are also showing an appreciable gain. Skilled labor is in good demand. Electrical jobbers reflect the same spirit of optimism in their reports. Good movements of merchandise are not confined to any particular group of items. Prices have been held fairly stable for some weeks, but there is a pronounced upward tendency which may reflect itself in higher prices at any time. The demand for Christmas goods is setting in well.

Conduit.—Rigid conduit continues to be in heavy demand. Stocks are short and deliveries are still uncertain. Prices are steady.

Outlet Boxes.—Demand is excellent, but stocks are rather low and deliveries slow.

Denver

Holiday Business Absorbing Interest—Flashlights Active—Report Radio Sales Increased 300 per Cent

Holiday business is absorbing the interest of local electrical men. Dealers' orders are increasing, and jobbers report ample stocks to meet demand, except in some numbers of heaters and hollow wire. Co-operative advertising of radio, vacuum cleaners and electrical Christmas gifts is responsible for considerable interest. Conditions are improved over last year and satisfactory volume is anticipated.

Flashlights.—Batteries are moving better than cases, although both are reasonably satisfactory.

Radio.—Increase of 300 per cent in sales reported. Parts are moving better than they have for a number of months.

Fixtures.—Glassware demand still holding up even with decreased building operations. Replacement business is good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Hoover Suction Sweeper Raises Capital Stock to $6,000,000

The Hoover Suction Sweeper Company, Canton, Ohio, has increased its capital stock from $2,000,000 to $6,000,000, and a new organization will be effected under the name of the Hoover Company. It is said the capital stock has been increased with a view of enlarging the manufacturing facilities and engaging the production of other electrical household appliances.

M. S. Wright Company Organizes Sweeper Vac Appliance Firm

To facilitate its internal administration, the M. S. Wright Company, manufacturer of vacuum cleaners, Worcester, Mass., has organized as a subsidiary the Sweeper Vac Appliance Company. The capital stock is $25,000. Henry R. King, general sales manager of the Wright company, is president; Clifford L. Wright, treasurer, and Walter C. Chandler, secretary.

Siemens Concern Celebrates Seventy-fifth Anniversary

On Oct. 12 the Siemens & Halske Aktiengesellschaft celebrated its seventy-fifth anniversary in Berlin, Germany. It was on Oct. 12, 1847, that Werner Siemens, the inventor of the dynamo and a multitude of other electrical devices, together with the mechanician Halske founded a small shop in Berlin for the purpose of manufacturing telegraph apparatus. From that day to this the executive control of the company has been in the hands of the Siemens family and the concern has branched out so that now it employs ninety thousand people and has more than sixty foreign offices. It is largely due to the fidelity of the management to the principles laid down by Werner Siemens that the company enjoys its worldwide fame.

Taplet Manufacturing Company Organized by E. A. Jenkins

E. A. Jenkins, actively associated with the H. T. Paiste Company, Philadelphia, for many years, has purchased the pipe-taplet portion of that company's business, including machinery, patterns, patents and good will. The Taplet Manufacturing Company has organized to conduct the new business and is to be entirely distinct and separate as to management and ownership. The Taplet company has its sales and manufacturing departments at 3907 Powelton Avenue, Philadelphia.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., formerly exclusive selling agents for the Paiste pipe taplets, has resigned this agency.

Manufacturers Oppose Hull Bill

Representatives of the National Association of Manufacturers, the National Metal Association, the National Founders' Association and thirty-nine state associations of manufacturers appeared on Nov. 29 before a House naval subcommittee to oppose enactment of the Hull bill, which would require the government to manufacture in arsenals and navy yards all articles for its use. The manufacturers contended that the bill would put the government in competition with private business on an unfair basis.

Wirt Company of Philadelphia Elects Stuckey President

The Wirt Company, 5221 Greene St., Philadelphia, manufacturer of electric lighting appliances, announces the retirement of its president, Charles Wirt.

At a meeting of the board of directors of the company held Monday, Nov. 13, the following officers were elected: P. H. Stuckey, president; H. J. Thayer, vice-president, and C. H. Chandler, secretary and treasurer. The active management of the business will devolve upon Mr. Stuckey, formerly treasurer and general manager, who has been associated with the company for more than twelve years.

Westinghouse Opens Its Bridgeport Sales and Service Quarters

To improve its service in the Bridgeport (Conn.) district, the Westinghouse Electric & Manufacturing Company has recently opened sales offices and service station facilities at Bruce Avenue and Seymour Streets, Bridgeport. These quarters will be used as a combined sales, service and warehouse center, with modern repair-shop facilities and stocks of material needed for immediate delivery on maintenance and other field repair work.

About 10,000 sq.ft. of floor space has been assigned to the initial installation, and all classes of repair work will be covered from large turbo-generators to small motors, etc.

All of Fairfield County, Conn., will be within easy reach of the new quarters, and the establishment will be in close touch with the New York and other Eastern offices of the company. W. P. Sidle has been appointed manager of the service department at Bridgeport, and George McElroy has been appointed sales manager.

Fifteen Million Dollars of Western Electric Common Stock Offered

The Western Electric Company, Inc., announced last week that it would sell $15,000,000 of its common stock to its stockholders at $100 a share. Each stockholder can subscribe to one share of the new stock for each two and one-third shares of common stock standing in his name on Nov. 28. The right to subscribe expires Dec. 27, and payment in full must be made by Dec. 30. The money will be used to retire the $15,000,000 issue of the first 5s of 1922, which mature Dec. 31.

The company is controlled by the American Telephone & Telegraph Company through a 98 per cent ownership of the 350,000 outstanding shares of no-par-value common stock. Early in the year the American Telephone & Telegraph Company sold $115,000,000 of common stock.

Establishes Pioneer Industrial Electric Heating Store

What is believed to be the first store in the country to display industrial electric heating apparatus alone on a demonstration-sale basis is in operation at 194 Friendship Street, Providence, R.I., under the proprietorship of C. I. Hayes, for many years a manufacturer and distributor of this class of equipment.

Through the co-operation of the Narragansett Electric Lighting Company, Providence, the establishment has been quoted a rate satisfactory for demonstrations, and a 30-kw. transformer installation has been made to supply energy at 110 and 220 volts. More than 1,000 kw. in industrial heating apparatus of the Hayes organization's production is in service on the lines of the Narragansett company.

The organization has engaged J. E. Hines as sales manager. Mr. Hines' thirteen years' service with the Hoskins Manufacturing Company, Detroit, have fitted him for the work undertaken at Providence. At present the activities of the concern are largely confined to southern New England on account of the policy of the house to maintain service to customers utilizing this type of equipment. The Hayes products are manufactured in a plant of the organization outside the city limits, and the display room at the new store is utilized to demonstrate these and other equipments for which it is a sales representative.

The equipment on display includes a metal heater, a heavy-duty furnace, a water heater, a temperature-regulating panel, "hump method" equipment for steel hardening, high and low temperature furnaces, ovens, glue pots, recorders and control apparatus.

The B-R Electric Company, Fifteenth and Walnut Streets, Kansas City, Mo., has under construction a five-story-and-basement reinforced-concrete warehouse at 1411 Walnut Street, which the company expects will be ready for occupancy April 1, 1923.

Illinois Electric of California Building to Cost $250,000

The new building of the Illinois Electric Company shown in the accompanying picture is being erected at West San Pedro and Boyd Streets, Los Angeles, at a cost of $250,000.

In addition to serving as office and warehouse of this organization in the Southwest, many features new to a wholesale house have been introduced. The company has installed a complete servicing department with a stock of parts sufficient to take care of all equipment handled by it and is prepared to handle repairs at cost for dealers not in a position to do their own service work.

NEW BUILDING OF LOS ANGELES JOBBING FIRM

Much attention is being given the street-lighting and industrial lighting departments, and a model display of modern methods of illumination is to be installed which will not only serve as an example to the customer in the electrical field but will enable salesmen to bring in their industrial "prospects" for a practical demonstration of modern lighting methods.

This California company was organized in 1911 with but four employees; it now has a staff of more than 100. With the rapidly growing demands of this section of the country in view, the present headquarters of the company are being planned to care for future expansion.

The Brown-Boveri Company, Baden, Switzerland, has just obtained an order for a 10,000-kw. turbo-generator for the first government station at Moscow. It is said that additional orders will be placed with this company by the Moscow authorities.

The National Carbon Company, Madison Avenue, Northwest, and One Hundred and Seventeenth Street, Cleveland, manufacturer of electric batteries and kindred specialties, is said to have tentative plans for the establishment of a new service and factory branch at Dallas, Tex.

The Koch & Sterzel Company, Dresden, Germany, manufacturer of transformers, has recently completed an installation for obtaining an alternating potential of 1,000,000 volts at the Freiberg Porcelain Works. This installation will be used for the examination of high-voltage insulators. Koch & Sterzel intend building another installation with an alternating potential of 2,000,000 volts.

The Freeman Electric Company, 803 South State St., Trenton, N. J., manufacturer of electrical products, has revised plans for a one-story unit at its proposed new factory at Mead and Prince Streets, including improvements in the present building. E. H. Freeman is president of the company.

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., manufacturer of electrical supplies, is erecting a one-story, 50-ft. x 120-ft. steel addition at its plant on Bishop Avenue, Bridgeport.

H. Sutter, 428 Erie Street, Elmira, N. Y., is arranging for the installation of equipment in a local building for the manufacture of radio equipment and parts.

The International Oxygen Company, Newark, N. J., announces that A. A. Heller has taken over its management in place of L. W. Hench, secretary and general secretary, resigned.

The Crompton & Knowles Loom Works, Inc., Worcester, Mass., has awarded a contract for a one-story addition to its Providence plant, 50 ft. x 170 ft., with a basement. The main floor will be equipped as an erection shop.

The Chemical Equipment Association, comprising manufacturers of equipment essential to manufacture in the score or more chemically controlled industries of the continent, has established national executive offices at 1,328 Broadway, New York City. It has begun active work through a national membership for the fostering of trade in chemical equipment and for the improvement of practices in the production and distribution of such equipment and in the performing of engineering services incidental thereto.

The Safety Car Heating & Lighting Company, Dixwell Avenue, New Haven, Conn., manufacturer of electric lighting and heating equipment for railroad service, will erect a new one-story plant addition, 106 ft. x 115 ft.

The Kerite Insulated Wire & Cable Company, 30 Church Street, New York City, with plant at Seymour, Conn., is arranging for the sale of common stock for $1,000,000, provided by an increase in capital from $200,000 to $1,200,000, a portion of the proceeds to be used for extension and improvements to the plant.

The Mitchell Vance Company, New York City, lighting fixture manufacturer, announces that Henry H. Russell is now associated with its organization as an executive sales representative. Mr. Russell is well known for his development of unusual selling "stunts." Some years ago, while in California, he signed contracts in a captive balloon 3,500 ft. over the city of Los Angeles. About two years ago he conceived the idea of delivering an electric range by airplane from Atlanta to Rome, Ga., a distance of 75 miles. The delivery was made in eighty-seven minutes, and on its arrival a successful demonstration of electric cooking was given before the Rome Women's Club.

The Lewis Electric Manufacturing Company, Inc., 1400 Niagara Street, Buffalo, which was recently incorporated to manufacture mechanical appliances, will have its early production done by contract and some time later will be in the market for equipment for factories of its own. Standard production will probably not begin until about Jan. 1. E. Sears Yates is secretary of the company.

The Royal Fixture Corporation, Milwaukee, has been incorporated with a capital stock of $50,000 to manufacture electric illuminating fixtures, lamps, electrical devices, etc. The building at 85 Thirty-fifth Street has been taken over and is being equipped as a machine and assembling shop. The principals are David C. Loppin, 679 Forty-eighth Street, and Sam Rabucehin, 844 Eleventh Street, Milwaukee.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of a firm in the United States desires an agency in Palestine (No. 4,506) for electric bulbs for motor cars, of single and double contact, lamps and lanterns, agricultural implements, etc.

Purchase and agency is desired in Switzerland (No. 4,510) for engineering equipment and supplies, refrigerator equipment, power transmissions, driving belts, etc.

Purchase is desired in Hungary (No. 4,512) for iron sheets for generators and transformers and galvanized-iron sheets.

Agency and purchase is desired in New Zealand (No. 4,526) for self-contained electric plants and material suitable for installations for residences, offices, farms and shops; electric novelties and small engines, suitable for shops, dairies and farm use.

Purchase is desired in Canada (No. 4,527) of a direct-connected generator to develop from 350 hp. to 500 hp., twenty motors from 10 hp. to 75 hp., transmission machinery for lumber, etc.

Purchase and agency is desired in India (No. 4,565) for motor cars, motor cycles, electric fittings, automobile parts and accessories, etc.

An agency is desired in India (No. 4,576) for electrical goods, motor accessories, etc.

The following inquiries have recently been received by the Philadelphia Commercial Museum, which will furnish the names and addresses of the inquirers by mentioning the number given:

An agency is desired by a firm in Barrancas, Venezuela (No. 40,296), for electric lighting sets of about ten lamps capacity, with air-cooled motor, low voltage and necessary storage batteries, at a price from $60 to $80.

Catalogs and price lists are desired in Mazatlan, Mexico (No. 40,297), of electrical apparatus for medical purposes, including a Rhumkorff coil for producing 8-in. sparks.

An agency is desired in Switzerland (No. 40,301) for wireless telephone apparatus.

Catalogs and price lists are desired in Mexico City (No. 40,307) of electric baking ovens.

PROPOSED ELECTRIC PLANT FOR SAN JOSÉ, COSTA RICA.—The municipality of San José, Costa Rica, has decided to install a new electric power plant of sufficient capacity to supply electricity to light the entire city and to furnish power for industrial plants.

ERECTION OF LARGE HYDRO-ELECTRIC PLANTS IN CZECHOSLOVAKIA CONTEMPLATED. — Plans are reported under way for the construction of large hydro-electric plants at Seestadtl and Kaaden. Work is also under way in linking up the power stations in northeastern Bohemia.

New Apparatus and Publications

RAPID TRANSIT SYSTEMS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 44,018, entitled "Metropolitan Subways and Elevated Systems," in which it describes the principal characteristics of several large rapid-transit systems.

ELECTRIC RANGES. — The Standard Electric Stove Company, Toledo, Ohio, is distributing a catalog covering its electric cooking apparatus, including ranges, coffee urns, combination griddle, broiler and toaster, hot plates, etc.

RAILWAY ELECTRIFICATION. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has published a pamphlet (Reprint No. 128) containing an article on "Advantages of Railroad Electrification," by R. J. O'Brien of its heavy traction department.

VENTILATING SET.—The L. J. Wing Manufacturing Company, 352-362 West Thirteenth Street, New York City, is distributing a folder covering its "W-S Vent Set" for ventilation of residences, offices and laboratories.

BATTERY CLIP.—The Mueller Electric Company, 1,583 East Thirty-first Street, Cleveland, is distributing a leaflet calling attention to the improvement in its No. 21-A "Universal" battery clip.

DETECTOR AMPLIFIER UNIT. — A complete detector-amplifier unit for amateurs, professionals and schools has been brought out by the Betts & Betts Corporation, 645 West Forty-third Street, New York City.

New Incorporations

THE CADDO (TEX.) ICE, LIGHT & POWER COMPANY has been incorporated with a capital stock of $30,000 by Peter Swenson, S. T. Swenson and O. C. Goodwin.

THE KING'S ROAD ELECTRIC LIGHT LINE, Jacksonville, Fla., has been incorporated with a capital stock of $3,000 to distribute electricity for light and power purposes. The officers are: Albert Klein, president; George F. Foy, vice-president; J. R. McKinley, secretary, and P. C. Nickerson, treasurer.

THE MISSOURI ELECTRIC LIGHT & POWER COMPANY, St. Louis, Mo., has been chartered by L. M. Egan, F. J. Boercher, L. E. Boehm, J. E. Young and others. The company will take over the property of the Union Electric Light Company of St. Louis. Under the charter the company is authorized to issue 250,000 shares of preferred capital stock, par value $100 each, and 650,000 shares of common stock of no par value.

THE NORTHERN INDIANA POWER COMPANY, Kokomo, Ind., has been granted a charter with a capital stock of $3,500,000. The company proposes to acquire seven utility companies operating in northern Indiana. The directors are Joseph H. Brewer and Charles O. B. Murphy.

THE NORTH MISSOURI POWER COMPANY, Excelsior Springs, Mo., has been incorporated with a capital stock of $1,500,000 to take over the properties of the Excelsior Springs Water, Gas & Electric Company and its subsidiaries. W. A. J. Bell is president and S. W. Henderson vice-president and general manager.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Illuminating Company contemplates extensions and improvements in present power plants, lines, etc., during 1923, to cost about $4,500,000.

MARLBORO, MASS. — The Board of Aldermen has decided to replace the lamps now in use on East Main, West Main Mechanic and Lincoln Streets with 600-cp. "Nova Lux" lamps.

SAUGUS, MASS. — The Universal Tide Power Company has been granted permission to issue $35,000 in capital stock; the proceeds to be used for additional equipment, etc., to its local power plant.

WORCESTER, MASS.—The New England Power Company is preparing plans for a number of transmission lines and new central distributing plant for the eastern Massachusetts district, to cost about $200,000.

Middle Atlantic States

LANCASTER, N. Y.—The Public Service Commission has granted the Depew & Lancaster Light & Power Company permission to erect an electric lighting system in the towns of Java, Sheldon and Bennington under franchises granted by the three townships.

MECHANICSVILLE, N. Y. — George P. Ide & Company, Troy, will erect a power house at their proposed local factory, to cost $100,000. Edward T. Loth, 253 Broadway, Troy, is architect.

PARMA, N. Y.—The Public Service Commission has granted the Cooper Electric Corporation, Hilton, permission to construct an electric plant to supply service in Parma. It also approved the exercise by the Cooper Electric Company of certain franchise rights granted to the Hilton Electric Light, Power & Heat Company.

NEW YORK, N. Y.—The Empire State Ice Company, 76 West Monroe Street, Chicago, will install electric power equipment, ice and refrigerating machinery at its proposed plant at 161st Stret and Grant Avenue, to cost $200,00.

POTSDAM, N. Y.—The Public Service Commission has granted the St. Lawrence Transmission Company permission to construct a transmission and distribution system in the towns of DeKalb and Hermon.

TONAWANDA, N. Y.—The Tonawanda Power Company will install a lighting system on Military and River Roads.

CAPE MAY, N. J.—The Atlantic (N. J.) City Electric Company will build a transmission line from Cape May to Wildwood Junction and extend its distributing system in this section. The local utility properties recently acquired will be merged with the main system.

ELIZABETH, N. J.—The lumber plant, including sawmill, power house and equipment, of the Heidritter Lumber Company, South Front Street, was damaged by fire recently, causing a loss of about $100,000.

HAMMONTON, N. J.—The Littlefield Ice & Coal Company will install electric equipment in its proposed ice-manufacturing and cold-storage plant, to cost about $60,000.

MILLVILLE, N. J.—The Court of Errors has affirmed a decision by Supreme Court Justice Thomas W. Trenchard upholding the right of city of Millville, under an act of 1917, to construct an electric distributing system.

SUMMIT, N. J. — The Commonwealth Electric Company and affiliated interests, the Commonwealth Water & Light Company, the Lakewood & Coast Electric Company and the Lakewood Coast Water & Electric Company have been acquired by the Albert Emanuel Company, 61 Broadway, New York. The new owner plans immediate extensions and improvements.

FREEBURG, PA. — The Pennsylvania Power & Light Company, Allentown, is planning to extend its transmission line from Selinsgrove to Freeburg to furnish electrical service here.

HAMBURG, PA.—The Hamburg Gas & Electric Company has received permission to acquire the properties of the Greenwich, Lenhartsville, Albany, Bern and Richmond Electric companies, operating in this vicinity. The lines will be merged with the system of the purchasing company and extensions and improvements made.

HUNTINGDON, PA.—The Cover Electric Company contemplates extensions and improvements, to cost about $25,000.

JOHNSTOWN, PA.—The Penn Public Service Company has received permission to acquire the properties of the Lumber City, Confluence, Boswell and Armagh Electric Companies. The systems will be merged and extended.

LANSFORD, PA. — The Pennsylvania Power & Light Company will build a transmission line from its Hauto power plant to Lansford via Northampton.

MORGANTOWN, PA. — The Superior Block Coal Company, recently organized, wil install electric power equipment at its local properties. Harold S. Smith heads the company.

PHILADELPHIA, PA. — The Pennsylvania Sugar Company, 1045 North Delaware Avenue, will build a one-story power house at its plant. Bids will be asked early in January.

SCRANTON, PA.—The Adams Electric Company, the Adams Power Company and the York Power Company, recently organized to operate in West Manheim, Mount Joy and Berwick Township, plan to erect transmission and distributing lines. F. Heinbokel, Scranton, is treasurer.

YORK, PA. — The Gilbert Wall Paper Company, 728 Linden Avenue, will build a one-story power house at its proposed new factory on State Street. J. A. Dempwolf, Casset Building, is architect.

BALTIMORE, MD.—The American Ice Company, Calvert Building, will install electric power equipment at its proposed new plant on Edon Street, to cost $100,000. G. Leslie Weir, 41 East Forty-second Street, New York, is architect.

HAVRE DE GRACE, MD.—The property of the Havre de Grace Electric Company has been purchased by the Northern Maryland Electric Company, Oxford, Pa. Work will begin at once by the new company on the erection of a transmission line to connect Havre de Grace with Port Deposit.

WOODMONT, MD.—The installation of a municipal electric light plant in Wood-

mont is under consideration. Post office address is Little Orleans.

CLIFTON, W. VA. — The Clifton Coal Company plans to rebuild its power house, recently destroyed by fire.

HUNTINGTON, W. VA.—The Coal River Collieries Company will install motors and other electric equipment at its properties, to cost about $100,000.

JANELEW, W. VA.—The Monongahela Power & Railway Company contemplates the installation of a commercial light and power service here.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company contemplates rebuilding its local plant, recently destroyed by fire, causing a loss of about $30,000.

LOST CREEK, W. VA.—The Vulcan Coal Company will install electric power equipment at its properties.

MARTINSVILLE, VA. — The American Furniture Manufacturing Company plans to build a power plant in connection with its proposed furniture factory.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies & Accounts, Navy Department, until Dec. 19 for one switchboard for the Puget Sound Navy Yard (Schedule 343); also for a quantity of flashlights and batteries for Eastern and Western yards (Schedule 344).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Dec. 12 for 250 landing light switches, for use at Fairfield, Ohio, and Keyport, N. J. (Circular 23-71).

WASHINGTON, D. C.—Bids will be received by the Board of Commissioners, District Building, until Dec. 14 for electric lighting fixtures for the new Eastern High School.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 18 for condensers, telephone generators, resistances, vibrators, etc. (Circular PR-12858-1CP); also, until Dec. 15 for 4,000 hand-receiver cords, 2,000 switchboard transmitter cords, 800 switchboard connector cords, etc. (Circular PR-13270-1CP); until Dec. 19 for armature for motor generator, rectifiers, switches, etc. (Circular PR-13228-1CP.)

North Central States

DETROIT, MICH.—Tentative plans are being prepared by the Detroit Edison Company for a generating plant at Slocum's Island, to cost about $8,000,000, with transmission system. A substation will be erected at Ecorse Avenue and Dearborn Street.

LANSING, MICH.—The United Produce Company will install electric power equipment in its proposed refrigerating and cold-storage plant, to cost about $200,000. Warren M. Holmes, Tussing Building, is architect.

ST. JOSEPH, MICH.—Plans are being prepared by Cahill & Douglas, engineers, 217 West Water Street, Milwaukee, for a power plant and smokestack for the Whitcomb Hotel.

COSHOCTON, OHIO.—The Ohio Service Company, which has purchased the properties of the Sugarcreek (Ohio) Light & Power Company, the Battery Company and the Cadiz (Ohio) Electric Light & Power Company, is planning to erect a 12-mile, 33,000-volt transmission line from New Philadelphia to Sugarcreek; a 4-mile line between Strasburg and Zoar, and a 26-mile, 33,000-volt line from Dennison to Cadiz, via Conotton, Bowerston, Jewett and Scio. The company has been granted franchises in Scio and Jewett.

ELYRIA, OHIO.—The Ohio Public Service Company is securing right-of-way to Ashland, 55 miles, for a new 132,000-volt transmission line. The cost is estimated at about $1,500,000.

LORAIN, OHIO.—The City Council has authorized the Ohio Public Service Company to install an ornamental lighting system, to cost about $15,000.

CLINTON, IND. — The Wabash Valley Electric Company plans to erect a transmission line to connect its power plants at Clinton and Sullivan. New distributing lines will be installed along the route in Vigo County.

GARY, IND.—The Gary Street Railway Company will make extensions to its system, including the installation of new equipment, to cost about $500,000.

CHICAGO, ILL.—E. J. Brach & Sons, 215 West Ohio Street, will build a power house in connection with their three-story candy-manufacturing plant to be erected at 401 North Kilpatrick Street.

FORT ATKINSON, WIS.—Bonds to the amount of $38,000 have been voted for improvements to the municipal electric light plant.

KENNAN, WIS.—The Village Board has engaged Earl D. Jackson, Endicott Building, St. Paul, consulting engineer, to prepare plans for a municipal hydro-electric plant, with steam auxiliary power station, to cost about $35,000.

KENOSHA, WIS. — A proposition has been submitted to the County Board of Supervisors, the cities of Kenosha and Racine by the Wisconsin Gas & Electric Company offering to install electric lamps on the Sheridan Road between these two cities, a distance of 12 miles. The company has installed twenty 400-cp. (sample) lamps for a distance of 1 mile to demonstrate the possibilities of highway lighting.

KIEL, WIS.—The Board of Supervisors of Manitowoc County has granted the Oslo (Wis.) Light & Power Company a franchise to erect transmission lines in the towns of Manitowoc Rapids, Cato and Newton.

KIEL, WIS.—The Wisconsin Public Service Company, Green Bay, has petitioned the Board of Supervisors of Manitowoc County for permission to erect transmission lines between Manitowoc Rapids and Valders, from Manitowoc Rapids to Newton, between the east and west boundaries of the town of Cato and in the town of Rockland.

MILWAUKEE, WIS. — The Milwaukee Electric Railway Light & Power Company contemplates extending its transmission line from Whitewater to West Allis.

MILWAUKEE, WIS. — The Railroad Commission has granted the Milwaukee Electric Railway & Light Company permission to issue $6,500,000 in bonds, part of the proceeds to be used to reimburse the treasury for expenditures for extensions already made and also for future extensions.

OAKFIELD, WIS.—The Eastern Wisconsin Electric Company has acquired the property of the Oakfield Light & Power Company. Improvements in the transmission line are contemplated by the purchasing company.

SHEBOYGAN, WIS.—The installation of an ornamental lighting system on North Eighth Street is under consideration by the lighting committee.

STEVENS POINT, WIS.—The Consolidated Water Power & Paper Company is considering enlarging its local hydro-electric plant.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates the erection of a 20,000-volt, three-phase transmission line from Edgar to Stratford.

ROCHESTER, MINN. — The Wisconsin-Minnesota Light & Power Company has submitted a proposal to the City Council to furnish electricity in this city. The proposed plan provides for the erection of a transmission line from Rochester to connect with its station at Red Wing, at a cost of about $100,000, to be paid by the city, the company to reimburse the city in five yearly installments. To meet the increasing demand for electricity, it is stated that it will soon be necessary to install a generating unit at the municipal electric plant and the company offers this plan as a substitute.

BOLIVAR, MO.—Alexander & Baity, 535 West Commercial Street, Springfield, Mo., it is reported, are considering installing an electric light and power plant in Bolivar, to cost about $32,000.

KANSAS CITY, MO.—Electric power equipment will be installed in the proposed addition to the grain elevator of the Missouri, Kansas & Texas Railroad Company, to cost about $2,000,000.

MOUNTAIN GROVE, MO.—Extensions to the municipal electric light plant and waterworks system, to cost about $25,000, are under consideration.

ST. LOUIS, MO.—The Litton Veneer Company, Rockford, Ill., will build a power house at its proposed local plant on Nettleton Street.

HUBBELL, NEB.—Bonds to the amount of $10,000 have been voted for the construction of a transmission line to Superior, Neb.

WAHOO, NEB.—The first electric light district of Saunders County has applied to the State Railway Commission for permission to issue $30,000 in bonds for the purpose of erecting a transmission line from part of four precincts lying south and east of Wahoo to the city, where connection will be made with the municipal electric light plant. C. E. Kellar is secretary of the company.

KANORADO, KAN. — Plans are being prepared for a transmission line and a local distributing system. W. B. Rollins & Company, Exchange Building, Kansas City, Mo., are engineers.

Southern States

DAVIDSON, N. C.—Bonds to the amount of $60,000 have been voted for the installation of a municipal electric light and water plant.

HIGH POINT, N. C.—The Robbins Knitting Company will build an electric substation at its proposed local mill.

FLORENCE, S. C.—The Palmetto Light & Power Company contemplates improvements to its system, to cost about $32,000.

GREAT FALLS, S. C. — The Republic Cotton Mills, Inc., will build an electric generating plant in connection with its proposed new mill, to cost about $1,000,000. J. E. Sirrine, Greenville, S. C., engineer.

SEBRING, FLA.—Plans are being considered for extensions and improvement in the municipal power plant, recently acquired from the Sebring Light & Water Company.

DOTHAN, ALA. — The Houston Power Company has applied to the Public Service Commission for permission to extend its transmission line from Slocomb, Ala., to Graceville, Fla., to furnish electricity in the latter place.

GADSDEN, ALA.—The Gulf States Steel Company will build a transmission line to its local plant, which will be electrified.

HATTIESBURG, MISS. — The Acme Flooring Company, recently organized, will build a power house in connection with its proposed local hardwood mill.

MAGEE, MISS. — Improvements to the municipal electric plant and waterworks, to cost about $25,000, are under consideration. Swanson-McGraw, Inc., United Fruit Building, New Orleans, are consulting engineers.

HEBER SPRINGS, ARK. — The City Council has granted E. F. Stanfield and associates a fifty-year franchise to furnish electricity in Heber Springs.

COUSHATTA, LA.—The Gulf State Land & Lumber Company will install electric power equipment at its lumber mill.

LECOMPTE, LA.—The Council is considering an issue of $40,000 in bonds for extensions to the municipal electric lighting system and waterworks.

OKMULGEE, OKLA.—The Phillips Higrade Refining Company will build a power house in connection with improvements and extensions to its plant, to cost about $500,000.

TULSA, OKLA.—The Taylor Paper Company, Memphis, Tenn., will build a power house in connection with its proposed local mill, to cost about $100,000.

CADDO, TEX.—The Caddo Ice, Light & Power Company will make extensions to its power plant and ice-manufacturing plant.

JEFFERSON, TEX. — Plans are being prepared by the Jefferson Ice & Light Company for the installation of a street-lighting system, to cost about $30,000.

PERRYTON, TEX. — A bond issue of $35,000 is being arranged for a municipal light and power plant.

ROCKDALE, TEX.—The Texas Power & Light Company, it is reported, is planning to extend its transmission lines in Milam County to take in all the lignite mines and to erect a 2,300-volt line to Cameron, and also to Milano and Hearne, 30 miles further on.

SPEARMAN, TEX.—Bonds to the amount of $55,000 are being arranged, part of the proceeds to be used for extensions to the municipal electric light plant.

Pacific and Mountain States

TACOMA, WASH. — An ordinance has been passed authorizing an appropriation of $40,000 for the purchase of electric lamps.

PORTLAND, ORE.—The Pacific Power & Light Company is considering the construction of a transmission line to connect with the systems of the Montana Power Company and the Puget Sound Power & Light Company, to cost about $1,000,000.

VERNONIA, ORE. — A franchise has been granted to George Burdick for the installation of a light and power system.

BAKERSFIELD, CAL.—Plans are being prepared for the installation of an ornamental lighting system in the business district and an improved system in the residential section.

CARPINTERIA, CAL.—Steps have been taken by the local Chamber of Commerce

for the establishment of a new lighting district here.

EXETER, CAL.—Plans are being considered for the installation of an ornamental lighting system on Pine Street, to cost about $6,400.

FRESNO, CAL.—The installation of new electroliers in Commercial Park is being advocated by H. E. Patterson, manager of Fresno County Chamber of Commerce.

LOS ANGELES, CAL.—The Cemet Oil Company will erect a power house in connection with its proposed refining plant on East Twenty-sixth Street, to cost about $1,000,000.

LOS ANGELES, CAL.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected at Mormon Island by the Union Ice Company, San Francisco, to cost about $400,000.

MERCED, CAL.—The Turlock Irrigation District has applied to the Board of Supervisors of Merced County for a franchise to extend its electric system into Merced County.

PLACERVILLE, CAL.—Application has been filed with the Federal Power Commission by M. C. Seagrave of San Francisco for a combined power and irrigation project, including a dam and reservoir, on the headwaters of the Cosumnes River, near Placerville. The plans call for a development of about 13,000 hp.

WATSONVILLE, CAL. — Bonds to the amount of $225,000 have been voted for the purchase of the plant and distributing system of the Watsonville Power Company.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company contemplates erecting a new transmission line from Lake Buntzen to the suburbs of Vancouver.

ST. JOHN, N. B.—The City Council is considering the installation of an electric distribution system, including pole lines and underground conduit system.

TRURO, N. S.—A resolution has been adopted by the Town Council recommending the electric light commission to enter into a contract with the Nova Scotia Power Board to supply electricity in Truro.

ATWOOD, ONT.—The Atwood Lighting Company contemplates the installation of an electric lighting system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 14, 1922)

1,435,255. CHANGE-OVER SWITCH; E. Puxon, Hamilton, Ontario, Canada. App. filed July 5, 1919. For auxiliary supply source.

1,435,256. CONDUCTOR FOR ELECTRIC FURNACES; K. C. Randall and H. A. Travers, Wilkinsburg, Pa. App. filed July 10, 1918. Several hollow conductors twisted around common axis.

1,435,257. SYSTEM OF CONTROL; L. G. Riley, Wilkinsburg, Pa. App. filed Jan. 6, 1921. Method of determining whether railway controller is actuated too rapidly.

1,435,259. MEASURING INSTRUMENT; F. W. Boller, East Orange, N. J. App. filed July 30, 1917. Limited indicating space such as between 30 amp. and 40 amp.

1,435,262. SYSTEM OF CONTROL; K. A. Simmon, Edgewood Park, Pa. App. filed Feb. 18, 1920. Multiple-unit systems for railway service.

1,435,265. COIL-SUPPORTING MEANS FOR TRANSFORMERS; A. W. Thompson, East McKeesport, Pa. App. filed Aug. 7, 1917. Coils clamped rigidly in position.

1,435,281. MAGNETO; H. G. Cox, Chicago, Ill. App. filed June 23, 1919. Construction of armature.

1,435,306. BUTT-WELDED THIN-WALLED TUBING; G. V. Johnston, Chicago, Ill. App. filed June 9, 1919.

1,435,328. DISTORTION-MEASURING APPARATUS; H. Nyquist, Woodridge, N. J. App. filed Jan. 23, 1920. Measures distortion of telegraph signals.

1,435,333. TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, New York, N. Y. App. filed June 14, 1919. Employ machine-switching apparatus.

1,435,348. AUTOMATIC RINGING CIRCUITS; J. P. Toomey, New York, N. Y. App. filed June 5, 1919. Adapted for small switchboards.

1,435,380. ELECTRIC REGULATION; J. L. Creveling, White Plains, N. Y. App. filed April 9, 1917. Applicable to generator used to charge storage battery.

1,435,392. HEATING ELEMENT; C. J. Heisler, Los Angeles, Cal. App. filed March 5, 1921. Reinforced lead-in wire to prevent burning out.

1,435,421. ELECTRIC LIGHTING FIXTURE; H. C. Scharff, St. Louis, Mo. App. filed July 30, 1920. Universal joint for wall brackets.

1,435,427. LAMP; W. L. Stewart, Worcester, Mass. App. filed March 16, 1921. Combined gas and electric table light.

1,435,447. TELEPHONE-TRANMISSION SYSTEM; W. H. Bendernagel, Queens, N. Y. App. filed Dec. 9, 1919. Amplifying repeater in cord circuit.

1,435,455. ELECTRIC CURRENT CONTROLLING DEVICE; H. P. Donle, Meriden, Conn. App. filed Feb. 2, 1920. Vacuum-tube type.

1,435,468. ELECTRIC RANGE; G. W. Hart, West Hartford, Conn. App. filed June 5, 1922. Fuses and switches on face plate.

1,435,470. APPARATUS FOR BRAZING THIN METAL PARTS; W. F. Hosford, Oak Park, Ill. App. filed March 19, 1920.

1,435,474. ADVERTISING DEVICE; A. H. Jackson, London, Eng. App. filed April 22, 1922. Motor-controlled sign for street cars.

1,435,507. METHOD OF FORMING BALL BEARINGS; R. W. Sellew, New Britain, Conn. App. filed Oct. 19, 1920. Housing for bearings welded together.

1,435,559. ELECTRIC WATER HEATER; F. E. Shepard and J. E. Phillips, Tampa, Fla. App. filed June 5, 1922. Porcelain body, carbon electrodes and water spacing between electrodes.

1,435,596. POWER-TRANSMISSION MECHANISM; W. Fels, Elizabeth, N. J. App. filed May 16, 1918. Motor drive applied to reciprocating carriage.

1,435,671. ANODE; M. E. Stewart, Perth Amboy, N. J. App. filed March 10, 1922. Anode for electroplating bath with cross-section in form of cross.

1,435,675. AUTOMOBILE ALARM; C. D. Vollmer and M. Laskowitz, St. Louis, Mo. App. filed July 23, 1919. To prevent theft of car.

1,435,701. ELECTRIC REGULATION; J. L. Creveling, Tucson, Ariz. App. filed March 8, 1916. For variable-speed generator-charging batteries.

1,435,703. RECOVERY OF ZINC; J. T. Ellsworth, Park City, Utah. App. filed Dec. 17, 1921. By electrolysis.

1,435,711. SWITCH BOX; E. H. Kruse, Fort Wayne, Ind. App. filed March 5, 1921. Adapted to be mounted in partition so that its front is flush with wall.

1,435,742. PRODUCTION OF REFRACTORY METAL ALLOYS; B. D. Saklatwalla and Arthur N. Anderson, Crafton, Pa. App. filed April 8, 1920. Carbon used as reducing agent in electric furnace treatment.

1,435,749. SIGNAL; G. P. Springfield, Evansville, Ind. App. filed July 27, 1921. Indicates when trolley car starts or stops.

1,435,754. ELECTRIC SIGNAL LAMPS; M. J. Strasberger, Chicago, Ill. App. filed May 23, 1921. Indicates number of seats vacant in theater.

1,435,757. RADIO-TUNING COIL; Floyd Swink, St. Louis, Mo. App. filed May 8, 1920.

1,435,812. ELECTRIC SPOT-WELDING MACHINE; F. M. Cushing and W. L. B. Cushing, Los Angeles, Cal. App. filed April 7, 1920. Thermo-siphonic system of cooling electrodes.

1,435,813. ALTERNATING-CURRENT GENERATOR; F. Cutting, Tuxedo Park, N. Y. App. filed June 26, 1918. High-frequency radio generator.

1,435,819. MULTICONTACT ELECTRICAL CONNECTION; L. H. Des Isles, Chicago, Ill. App. filed Jan. 21, 1918. Thermo-electric circuits readily connected to common instrument.

1,435,827. ELECTRIC MOTOR SHORT-CIRCUITING MECHANISM; H. I. Finch, St. Louis, Mo. App. filed June 12, 1920. For induction-repulsion motors.

1,435,831. ELECTRIC SMOOTHING IRON; J. G. Fisher, McLean, Va. App. filed Sept. 2, 1921. Current controlled by switch placed in handle.

1,435,868. TELEMECHANIC INSTALLATION; A. M. Mayer, Levallois-Perret, France. App. filed Sept. 23, 1920. Transmitting motion by telegraph or radio.

1,435,870. AUTOMATIC CIRCUIT BREAKER; N. E. Nelson and O. Nelson, Seattle, Wash. App. filed Oct. 3, 1919. Remotely controlled breaker for high-voltage motor circuits.

1,435,875. ELECTROPLATING WITH ALKALINE BATH; C. H. Proctor, Arlington, and C. J. Wernlund, Woodbridge, N. J. App. filed Dec. 27, 1921. Method for introducing mercury into solution.

1,435,886. SEPARATION OF SOLIDS FROM LIQUIDS; W. Acton and W. M. McKean, Paisley, Scotland. App. filed Nov. 22, 1920. By passing electric current through aqueous sludge.

(Issued Nov. 21, 1922)

15,495 (reissue). WIRELESS SIGNALING SYSTEM; I. Langmuir, Schenectady, N. Y. App. filed Jan. 29, 1920. Heterodyne system of wireless transmission.

1,435,914. ELECTRICAL WELDING APPARATUS; A. Churchward, New York, N. Y. App. filed March 19, 1919. Portable rail-bonding plant.

1,435,919. CHILL; J. W. Fay, Milwaukee, Wis. App. filed Aug. 27, 1921. Relates to chills used for cooling or solidifying molten metal while welding.

1,435,931. TELEPHONE SYSTEM; J. H. Levis, Jr., Rochester, N. Y. App. filed Nov. 15, 1915. Distinctive and positive recall signal.

1,435,941. RADIO DIRECTION FINDER; James Robinson, Andover, Eng. App. filed Nov. 12, 1918. Pair of aërial coils in vertical planes rotated until no appreciable difference in signal is found.

1,435,946. MAGNETIC CHUCK; F. L. Simmons, Millbury, Mass. App. filed Nov. 5, 1914.

1,435,950. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Sept. 24, 1920. Control for charging booster battery.

1,435,966. IGNITION SYSTEM; C. F. Kettering, Dayton, Ohio. App. filed Aug. 5, 1918.

1,435,968. TELEPHONE TRUNK CIRCUITS; G. W. Kuhn and Eric R. Lundius, Brooklyn, N. Y. App. filed April 10, 1918. Relates to talking circuits between operators of associated exchanges.

1,435,980. MEANS FOR AND METHOD OF REDUCING CROSS TALK IN FOUR-WIRE CIRCUIT; R. A. Renshaw, Woodhaven, N. Y. App. filed Jan. 2, 1920.

1,435,989. ELECTRICALLY HEATED INTAKE MANIFOLD; M. A. Simon, St. Louis, Mo. App. filed Nov. 7, 1921.

1,435,994. METHOD OF ELECTRICALLY WELDING IN SERIES; A. C. Taylor, Warren, Ohio. App. filed Nov. 28, 1921. Welding together heads and stems of valves for combustion engines.

1,435,995. ELECTRIC RESISTANCE WELDING; A. C. Taylor, Warren, Ohio. App. filed March 11, 1922. Welding parts the connecting faces of which are uneven.

1,435,996. METHOD OF ELECTRIC RESISTANCE WELDING; A. C. Taylor, Warren, Ohio. App. filed March 11, 1922. Method of welding tubing, tanks and other hollow ware.

1,436,034. ELECTRIC HEATING UNIT OR HOT PLATE; L. R. Hamlin, Kokomo, Ind. App. filed April 11, 1921.

1,436,035. ELECTRIC SADIRON; L. R. Hamlin and Jesse Jackson, Kokomo, Ind. App. filed July 13, 1921. Improved terminal clip for resistance element.

1,436,060. HEATER FOR AUTOMOBILE RADIATORS; R. B. Strong, Coldwater, Mich. App. led Dec. 8, 1921. Hood placed in front of radiator containing electric lamps to prevent freezing.

1,436,089. ELECTRICAL WATER-HEATING DEVICE; Svend Gorlov, Miami, Fla. App. filed Feb. 27, 1922. Pipe attachment consisting of two electrodes with water completing circuit.

1,436,123. SYSTEM OF ELECTRICAL DISTRIBUTION; T. W. Varley, New York, N. Y. App. filed Sept. 6, 1919. Car-lighting system.

1,436,135. TELEPHONE-EXCHANGE; J. L. Wright, Cleveland, Ohio. App. filed July 12, 1917. Semi-automatic system employing switching mechanism.

1,436,137. ELEVATOR FLOOR SAFETY SWITCH; C. M. Aldred, Charlotte, N. C App. filed Dec. 22, 1921.

1,436,152. ELECTRICAL ENERGY TRANSLATING APPARATUS; A. Churchyard, New York, N. Y. App. filed April 28, 1919. Motor and generator for welding combined in one machine.

1,436,165. ELECTRICAL REGISTERING SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Oct. 6, 1919. Registering number of calls on party telephone line.

1,436,183. STATION INDICATOR; F. Mashinski, La Grange, Ohio. App. filed April 23, 1921. Audible signal operates when indicator changes.

1,436,206. TRANSMITTER; L. B. Speed, New York, N. Y. App. filed Nov. 19, 1919. Improved microphonic transmitting device.

1,436,212. RHEOSTAT; A. R. Swoboda, Newark, N. J. App. filed Dec. 6, 1920. Small variable resistance.

1,436,244. LOADING UNIT; W. Fondiller, New York, N. Y. App. filed Sept. 3, 1918. Loading of telephone lines.

1,436,245. ELECTRICAL ENGINE OF THE RECIPROCATING TYPE; Kurt M. Geisler, Hackensack, N. J. App. filed Nov. 19, 1920. Automatically makes and breaks the several circuits for solenoid windings.